National Aeronautics and
Space Administration
Langley Research Center

Scientific and Technical
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Scientific and Technical Aerospace Reports

STAR

Volume 48 Number 23

November 22, 2010

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NASA STI Program ... in Profile

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- TECHNICAL PUBLICATION. Reports of completed research or a major significant phase of research that present the results of NASA Programs and include extensive data or theoretical analysis. Includes compilations of significant scientific and technical data and information deemed to be of continuing reference value. NASA counterpart of peer-reviewed formal professional papers but has less stringent limitations on manuscript length and extent of graphic presentations.

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- CONTRACTOR REPORT. Scientific and technical findings by NASA-sponsored contractors and grantees.

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- SPECIAL PUBLICATION. Scientific, technical, or historical information from NASA programs, projects, and missions, often concerned with subjects having substantial public interest.

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  NASA STI Help Desk
  NASA Center for AeroSpace Information
  7115 Standard Drive
  Hanover, MD 21076-1320

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STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

STAR includes citations to R&D results reported in:

- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government agencies, domestic and foreign institution, universities, and private firms
- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

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NASA Center for AeroSpace Information (CASI)

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The U.S. Patent and Trademark Office (USPTO)

The U.S. Patent and Trademark Office provides online access to full-text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at http://www.uspto.gov/patft/.

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Subject Term Index

Personal Author Index

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 48, NUMBER 23 NOVEMBER 22, 2010

01
AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics, see categories 02 through 09. For information related to space vehicles see 12 Astronautics.

20100037207 NASA Glenn Research Center, Cleveland, OH, USA
Numerical Studies of a Supersonic Fluidic Diverter Actuator for Flow Control
Gokoglu, Suleyman A.; Kuczmarski, Maria A.; Culley, Dennis e.; Raghu, Surya; October 2010; 26 pp.; In English; 5th Flow Control Conference, 28 Jun. - 1 Jul. 2010, Chicago, IL, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.17.13.01
Report No.(s): NASA/TM-2010-216805; AIAA Paper 2010-4415; E-17437
ONLINE: http://hdl.handle.net/2060/20100037207
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The analysis of the internal flow structure and performance of a specific fluidic diverter actuator, previously studied by time-dependent numerical computations for subsonic flow, is extended to include operation with supersonic actuator exit velocities. The understanding will aid in the development of fluidic diverters with minimum pressure losses and advanced designs of flow control actuators. The self-induced oscillatory behavior of the flow is successfully predicted and the calculated oscillation frequencies with respect to flow rate have excellent agreement with our experimental measurements. The oscillation frequency increases with Mach number, but its dependence on flow rate changes from subsonic to transonic to supersonic regimes. The delay time for the initiation of oscillations depends on the flow rate and the acoustic speed in the gaseous medium for subsonic flow, but is unaffected by the flow rate for supersonic conditions
Author
Flow Velocity; Subsonic Flow; Internal Flow; Control Systems Design; Actuators; Acoustic Velocity; Pressure Regulators; Fluidics

02
AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also 34 Fluid Mechanics and Thermodynamics.

20100036783 NASA Ames Research Center, Moffett Field, CA, USA
Automatic Tip Vortex Core Profiling for Numerical Flow Simulations of Rotorcraft in Hover
Kao, David L.; Chaderjian, Neal M.; June 28, 2010; 17 pp.; In English; Original contains color illustrations
Report No.(s): ARC-E-DAA-TN1084
ONLINE: http://hdl.handle.net/2060/20100036783
No Copyright; Avail.: CASI

An automated approach is presented that extracts visual and quantitative data from vortex cores produced by Navier-Stokes simulations of rotorcraft in hover mode. This approach extracts contiguous rotor tip vortex-core trajectories, cross-flow velocity profiles, and vortex-core diameter variation with wake age (azimuth angle). This automated approach is faster and more accurate than a conventional manual approach. Moreover, this new approach allows for an efficient way to

quantitatively compare vortex-core profiles from different flow simulations, e.g., grid resolution studies, and validate computed results with experimental data
Author
Rotary Wing Aircraft; Hovering; Navier-Stokes Equation; Vortices; Cross Flow; Velocity Distribution; Simulation

20100037123 NASA Dryden Flight Research Center, Edwards, CA, USA
An Analytical Explanation for the X-43A Flush Air Data Sensing System Pressure Mismatch Between Flight and Theory
Ellsworth, Joel C.; June 14, 2010; 34 pp.; In English; 28th AIAA Applied Aerodynamics Conference, 28 Jun. - 1 Jul. 2010, Chicago, IL, USA; Original contains color illustrations
Report No.(s): DFRC-E-DAA-TN1615; DFRC-E-DAA-TN1737
ONLINE: http://hdl.handle.net/2060/20100037123
No Copyright; Avail.: CASI

Following the successful Mach 7 flight test of the X-43A, unexpectedly low pressures were measured by the aft set of the onboard Flush Air Data Sensing System s pressure ports. These in-flight aft port readings were significantly lower below Mach 3.5 than was predicted by theory. The same lower readings were also seen in the Mach 10 flight of the X-43A and in wind-tunnel data. The pre-flight predictions were developed based on 2-dimensional wedge flow, which fails to predict some of the significant 3-dimensional flow features in this geometry at lower Mach numbers. Using Volterra s solution to the wave equation as a starting point, a three-dimensional finite wedge approximation to flow over the X-43A forebody is presented. The surface pressures from this approximation compare favorably with the measured wind tunnel and flight data at speeds of Mach 2.5 and 3.
Author
Hypersonic Speed; Air Data Systems; Flight Tests; Wind Tunnel Tests; Three Dimensional Flow; Mach Number

20100037209 Boeing Co., Saint Louis, MO, USA
Inlet Flow Control and Prediction Technologies for Embedded Propulsion Systems
McMillan, Michelle L.; Gissen, Abe; Vukasinovic, Bojan; Lakebrink, Matthew T.; Glezer, Ari; Mani, Mori; Mace, James; October 2010; 52 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNC07CB76C; WBS 561581.02.08.03.21.66
Report No.(s): NASA/CR-2010-216779; E-17405
ONLINE: http://hdl.handle.net/2060/20100037209
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Fail-safe inlet flow control may enable high-speed cruise efficiency, low noise signature, and reduced fuel-burn goals for hybrid wing-body aircraft. The objectives of this program are to develop flow control and prediction methodologies for boundary-layer ingesting (BLI) inlets used in these aircraft. This report covers the second of a three year program. The approach integrates experiments and numerical simulations. Both passive and active flow-control devices were tested in a small-scale wind tunnel. Hybrid actuation approaches, combining a passive microvane and active synthetic jet, were tested in various geometric arrangements. Detailed flow measurements were taken to provide insight into the flow physics. Results of the numerical simulations were correlated against experimental data. The sensitivity of results to grid resolution and turbulence models was examined. Aerodynamic benefits from microvanes and microramps were assessed when installed in an offset BLI inlet. Benefits were quantified in terms of recovery and distortion changes. Microvanes were more effective than microramps at improving recovery and distortion.
Author
Boundary Layers; Flow Distribution; Prediction Analysis Techniques; Propulsion System Performance; Turbulence Models; Active Control; Control Equipment; Fail-Safe Systems; Fluid Dynamics

20100037211 NASA Dryden Flight Research Center, Edwards, CA, USA
Aeroelastic Model Structure Computation for Envelope Expansion
Kukreja, Sunil L.; June 30, 2010; 20 pp.; In English; CD-ROM contains full text document in PDF format
Report No.(s): DFRC-E-DAA-TN1673
No Copyright; Avail.: CASI; CD-ROM

A conference presentation sharing aspects of aeroelastic model structure computation for envelope expansion.
Author
Aeroelasticity; Models; Aerodynamics; Aerothermodynamics

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety and 85 Technology Utilization and Surface Transportation.

20100036785 NASA Ames Research Center, Moffett Field, CA, USA
An Integrated Tool Suite for En Route Radar Controllers in NextGen
Mercer, Joey; Prevot, Thomas; Brasil, Connie; Mainini, Matthew; Kupfer, Michael; Smtih, Nancy; September 19, 2010; 11 pp.; In English; ICAS 2010 Congress, 19-24 Sep. 2010, Nice, France, France; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNA08AF13C; WBS 305295.02.07.01.05.10
Report No.(s): ARC-E-DAA-TN1903
ONLINE: http://hdl.handle.net/2060/20100036785
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This paper describes recent human-in-the-loop research in the Airspace Operations Laboratory at the NASA Ames Research Center focusing on en route air traffic management with advanced trajectory planning tools and increased levels of human-automation cooperation. The decision support tools were exercised in a simulation of seven contiguous high-altitude sectors. Preliminary data suggests the controllers were able to manage higher amounts of traffic as compared to today, while maintaining acceptable levels of workload.
Author
Air Traffic Control; Trajectory Planning; Airspace; Workloads (Psychophysiology); Routes

20100036786 NASA Ames Research Center, Moffett Field, CA, USA
Effect of Dynamic Sector Boundary Changes on Air Traffic Controllers
Jung, Jaewoo; Lee, Paul; Kessell, Angela; Homola, Jeff; Zelinski, Shannon; August 02, 2010; 6 pp.; In English; AIAA Guidance, Navigation, and Control Conference, 2-5 Aug. 2010, Toronto, Ontario, Canada, Canada; Original contains color illustrations
Contract(s)/Grant(s): NNAS203144; NNA08AF13C; WBS 411931.02.07.01.31.23
Report No.(s): ARC-E-DAA-TN1919
ONLINE: http://hdl.handle.net/2060/20100036786
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The effect of dynamic sector boundary changes on air traffic controller workload was investigated with data from a human-in-the-loop simulation. Multiple boundary changes were made during simulated operations, and controller rating of workload was recorded. Analysis of these data showed an increase of 16.9% in controller workload due to boundary changes. This increased workload was correlated with the number of aircraft handoffs and change in sector volume. There was also a 12.7% increase in average workload due to the changed sector design after boundary changes. This increase was correlated to traffic flow crossing points getting closer to sector boundaries and an increase in the number of flights with short dwell time in a sector. This study has identified some of the factors that affect controller workload when sector boundaries are changed, but more research is needed to better understand their relationships.
Author
Air Traffic Controllers (Personnel); Boundaries; Workloads (Psychophysiology); Ratings; Simulation

20100036787 NASA Ames Research Center, Moffett Field, CA, USA
Incorporating Active Runway Crossings in Airport Departure Scheduling
Gupta, Gautam; Malik, Waqar; Jung, Yoon C.; August 02, 2010; 11 pp.; In English; AIAA Guidance, Navigation, and Control Conference, 2-5 Aug. 2010, Toronto, Ontario, Canada, Canada; Original contains color illustrations
Contract(s)/Grant(s): NNS0203144; WBS 411931.02.72.01.22
Report No.(s): ARC-E-DAA-TN1231
ONLINE: http://hdl.handle.net/2060/20100036787
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A mixed integer linear program is presented for deterministically scheduling departure and ar rival aircraft at airport runways. This method addresses different schemes of managing the departure queuing area by treating it as first-in-first-out

queues or as a simple par king area where any available aircraft can take-off ir respective of its relative sequence with others. In addition, this method explicitly considers separation criteria between successive aircraft and also incorporates an optional prioritization scheme using time windows. Multiple objectives pertaining to throughput and system delay are used independently. Results indicate improvement over a basic first-come-first-serve rule in both system delay and throughput. Minimizing system delay results in small deviations from optimal throughput, whereas minimizing throughput results in large deviations in system delay. Enhancements for computational efficiency are also presented in the form of reformulating certain constraints and defining additional inequalities for better bounds.
Author
Airports; Crossings; Runways; Takeoff; Scheduling

20100036788 NASA Ames Research Center, Moffett Field, CA, USA
Configuring Airspace Sectors with Approximate Dynamic Programming
Bloem, Michael; Gupta, Pramod; September 20, 2010; 13 pp.; In English; International Congress of the Aeronautical Sciences 2010, 19-24 Sep. 2010, Nice, France, France; Original contains color illustrations
Contract(s)/Grant(s): NAS2-03144; WBS 411931.02.31.01.02
Report No.(s): ARC-E-DAA-TN1935
ONLINE: http://hdl.handle.net/2060/20100036788
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In response to changing traffic and staffing conditions, supervisors dynamically configure airspace sectors by assigning them to control positions. A finite horizon airspace sector configuration problem models this supervisor decision. The problem is to select an airspace configuration at each time step while considering a workload cost, a reconfiguration cost, and a constraint on the number of control positions at each time step. Three algorithms for this problem are proposed and evaluated: a myopic heuristic, an exact dynamic programming algorithm, and a rollouts approximate dynamic programming algorithm. On problem instances from current operations with only dozens of possible configurations, an exact dynamic programming solution gives the optimal cost value. The rollouts algorithm achieves costs within 2% of optimal for these instances, on average. For larger problem instances that are representative of future operations and have thousands of possible configurations, excessive computation time prohibits the use of exact dynamic programming. On such problem instances, the rollouts algorithm reduces the cost achieved by the heuristic by more than 15% on average with an acceptable computation time.
Author
Airspace; Heuristic Methods; Algorithms; Horizon; Computation; Workloads (Psychophysiology)

20100036813 NASA Dryden Flight Research Center, Edwards, CA, USA
Advanced Command Destruct System (ACDS) Enhanced Flight Termination System (EFTS)
Tow, David K.; May 12, 2010; 21 pp.; In English; International Test and Evaluation Association (ITEA) 2010, 10-13 May 2010, Las Vegas, NV, USA; Original contains color illustrations
Report No.(s): DFRC-E-DAA-TN1606
ONLINE: http://hdl.handle.net/2060/20100036813
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Conference presentation sharing aspects of the Advanced Command Destruct System (ACDS) Enhanced Flight Termination System (EFTS).
Author
Abort Apparatus; Air Transportation; Flight Operations; Flight Tests; Blended-Wing-Body Configurations; Pilotless Aircraft

20100036829 NASA Langley Research Center, Hampton, VA, USA
Safety Arguments for Next Generation, Location Aware Computing
Johnson, C. W.; Holloway, C. M.; October 18, 2010; 6 pp.; In English; 5th IET International System Safety Conference 2010, 18-20 Oct. 2010, Machester, UK
Contract(s)/Grant(s): WBS 757280.02.07.07.07
Report No.(s): NF1676L-10960
ONLINE: http://hdl.handle.net/2060/20100036829
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Concerns over accuracy, availability, integrity, and continuity have limited the integration of Global Positioning System

(GPS) and Global Navigation Satellite System (GLONASS) for safety-critical applications. More recent augmentation systems, such as the European Geostationary Navigation Overlay Service (EGNOS) and the North American Wide Area Augmentation System (WAAS) have begun to address these concerns. Augmentation architectures build on the existing GPS/GLONASS infrastructures to support location based services in Safety of Life (SoL) applications. Much of the technical development has been directed by air traffic management requirements, in anticipation of the more extensive support to be offered by GPS III and Galileo. WAAS has already been approved to provide vertical guidance for aviation applications. During the next twelve months, the full certification of EGNOS for SoL applications is expected. This paper discusses similarities and differences between the safety assessment techniques used in Europe and North America.
Author
Augmentation; Global Positioning System; GLONASS; Support Systems; Air Traffic Control

20100036832 NASA Dryden Flight Research Center, Edwards, CA, USA
Aircraft Loss of Control Study
Jacobson, Steven R.; March 03, 2010; 49 pp.; In English; Aerospace Control and Guidance Systems Committee, 3 Mar. 2010, Lake Tahoe, NV, USA; Original contains color illustrations
Report No.(s): DFRC-E-DAA-TN1319
ONLINE: http://hdl.handle.net/2060/20100036832
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Loss of control has become the leading cause of jet fatalities worldwide. Aside from their frequency of occurrence, accidents resulting from loss of aircraft control seize the public s attention by yielding large numbers of fatalities in a single event. In response to the rising threat to aviation safety, NASA's Aviation Safety Program has conducted a study of the loss of control problem. This study gathered four types of information pertaining to loss of control accidents: (1) statistical data; (2) individual accident reports that cite loss of control as a contributing factor; (3) previous meta-analyses of loss of control accidents; and (4) inputs solicited from aircraft manufacturers, air carriers, researchers, and other industry stakeholders. Using these information resources, the study team identified causal factors that were cited in the greatest number of loss of control accidents, and which were emphasized most by industry stakeholders. For each causal factor that was linked to loss of control, the team solicited ideas about what solutions are required and future research efforts that could potentially help avoid their occurrence or mitigate their consequences when they occurred in flight.
Author
Air Transportation; Aircraft Control; Aircraft Accidents; General Aviation Aircraft; Flight Safety

20100036834 NASA Dryden Flight Research Center, Edwards, CA, USA
NASA UAS Update
Bauer, Jeffrey Ervin; Mulac, Brenda Lynn; April 16, 2010; 2 pp.; In English; UAS 2010 Conference and Exhibition, 16 Apr. 2010, Paris, France
Report No.(s): DFRC-E-DAA-TN1555
ONLINE: http://hdl.handle.net/2060/20100036834
No Copyright; Avail.: CASI

Last year may prove to be a pivotal year for the National Aeronautics and Space Administration (NASA) in the Unmanned Aircraft Systems (UAS) arena, especially in relation to routine UAS access to airspace as NASA accepted an invitation to join the UAS Executive Committee (UAS ExCom). The UAS ExCom is a multi-agency, Federal executive-level committee comprised of the Federal Aviation Administration (FAA), Department of Defense (DoD), Department of Homeland Security (DHS), and NASA with the goals to: 1) Coordinate and align efforts between key Federal Government agencies to achieve routine safe federal public UAS operations in the National Airspace System (NAS); 2) Coordinate and prioritize technical, procedural, regulatory, and policy solutions needed to deliver incremental capabilities; 3) Develop a plan to accommodate the larger stakeholder community at the appropriate time; and 4) Resolve conflicts between Federal Government agencies (FAA, DoD, DHS, and NASA), related to the above goals. The committee was formed in recognition of the need of UAS operated by these agencies to access to the National Airspace System (NAS) to support operational, training, development and research requirements. In order to meet that need, technical, procedural, regulatory, and policy solutions are required to deliver incremental capabilities leading to routine access. The formation of the UAS ExCom is significant in that it represents a tangible commitment by FAA senior leadership to address the UAS access challenge. While the focus of the ExCom is government owned and operated UAS, civil UAS operations are bound to benefit by the progress made in achieving routine access for government UAS. As the UAS ExCom was forming, NASA's Aeronautics Research Mission Directorate began to show renewed interest in UAS, particularly in relation to the future state of the air transportation system under the Next

Generation Air Transportation System (NextGen). NASA made funding from the American Recovery and Revitalization Act available in order to continue addressing the issue of routine civil UAS access.
Derived from text
Air Transportation; Airspace; NASA Programs; National Airspace System; Unmanned Aircraft Systems

20100036839 NASA Ames Research Center, Moffett Field, CA, USA
Integrated Traffic Flow Management Decision Making
Grabbe, Shon R.; Sridhar, Banavar; Mukherjee, Avijit; August 10, 2009; 18 pp.; In English; AIAA Guidance, Navigation, and Control Conference, 10-13 Aug. 2009, Chicago, IL, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS0203144; WBS 411931.02.41.01
Report No.(s): AIAA Paper 2009-6008; ARC-E-DAA-TN798
ONLINE: http://hdl.handle.net/2060/20100036839
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A generalized approach is proposed to support integrated traffic flow management decision making studies at both the U.S. national and regional levels. It can consider tradeoffs between alternative optimization and heuristic based models, strategic versus tactical flight controls, and system versus fleet preferences. Preliminary testing was accomplished by implementing thirteen unique traffic flow management models, which included all of the key components of the system and conducting 85, six-hour fast-time simulation experiments. These experiments considered variations in the strategic planning look-ahead times, the replanning intervals, and the types of traffic flow management control strategies. Initial testing indicates that longer strategic planning look-ahead times and re-planning intervals result in steadily decreasing levels of sector congestion for a fixed delay level. This applies when accurate estimates of the air traffic demand, airport capacities and airspace capacities are available. In general, the distribution of the delays amongst the users was found to be most equitable when scheduling flights using a heuristic scheduling algorithm, such as ration-by-distance. On the other hand, equity was the worst when using scheduling algorithms that took into account the number of seats aboard each flight. Though the scheduling algorithms were effective at alleviating sector congestion, the tactical rerouting algorithm was the primary control for avoiding en route weather hazards. Finally, the modeled levels of sector congestion, the number of weather incursions, and the total system delays, were found to be in fair agreement with the values that were operationally observed on both good and bad weather days.
Author
Air Traffic Control; Decision Making; Air Transportation; Weather; Management Planning

20100036846 NASA Glenn Research Center, Cleveland, OH, USA
Assessment of the State of the Art of Flight Control Technologies as Applicable to Adverse Conditions
Reveley, Mary s.; Briggs, Jeffrey L.; Leone, Karen M.; Kurtoglu, Tolga; Withrow, Colleen A.; September 2010; 31 pp.; In English
Contract(s)/Grant(s): WBS 645846.02.07.03.16
Report No.(s): NASA/TM-2010-216226; E-17212
ONLINE: http://hdl.handle.net/2060/20100036846
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Literature from academia, industry, and other Government agencies was surveyed to assess the state of the art in current Integrated Resilient Aircraft Control (IRAC) aircraft technologies. Over 100 papers from 25 conferences from the time period 2004 to 2009 were reviewed. An assessment of the general state of the art in adaptive flight control is summarized first, followed by an assessment of the state of the art as applicable to 13 identified adverse conditions. Specific areas addressed in the general assessment include flight control when compensating for damage or reduced performance, retrofit software upgrades to flight controllers, flight control through engine response, and finally test and validation of new adaptive controllers. The state-of-the-art assessment applicable to the adverse conditions include technologies not specifically related to flight control, but may serve as inputs to a future flight control algorithm. This study illustrates existing gaps and opportunities for additional research by the NASA IRAC Project
Author
Flight Control; Aircraft Control; Hazards; Damage; Adaptive Control

20100037208 NASA Glenn Research Center, Cleveland, OH, USA

Propulsion Health Monitoring of a Turbine Engine Disk Using Spin Test Data

Abdul-Aziz, Ali; Woike, Mark R.; Oza, Nikunj; Matthews, Bryan; Baaklini, George Y.; September 2010; 18 pp.; In English; Smart Structures and Materials and Nondestructive Evaluation and Health Monitoring 2010, 7-11 Mar. 2010, San Diego, Ca, USA; Original contains color illustrations

Contract(s)/Grant(s): NNC07ZRP001N; WBS 645846.02.07.03.11.03

Report No.(s): NASA/TM-2010-216743; E-17320

ONLINE: http://hdl.handle.net/2060/20100037208

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This paper considers data collected from an experimental study using high frequency capacitive sensor technology to capture blade tip clearance and tip timing measurements in a rotating turbine engine-like-disk-to predict the disk faults and assess its structural integrity. The experimental results collected at a range of rotational speeds from tests conducted at the NASA Glenn Research Center s Rotordynamics Laboratory are evaluated using multiple data-driven anomaly detection techniques to identify abnormalities in the disk. Further, this study presents a select evaluation of an online health monitoring scheme of a rotating disk using high caliber sensors and test the capability of the in-house spin system.

Author

Rotating Disks; Spin Tests; Anomalies; Detection; Structural Failure; Time Measurement; Turbine Engines

20100037765 NASA Langley Research Center, Hampton, VA, USA

A Criteria Standard for Conflict Resolution: A Vision for Guaranteeing the Safety of Self-Separation in NextGen

Munoz, Cesar; Butler, Ricky; Narkawicz, Anthony; Maddalon, Jeffrey; Hagen, George; October 2010; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 411931.02.51.07.01

Report No.(s): NASA/TM-2010-216862; L-19932; NF1676L-11543

ONLINE: http://hdl.handle.net/2060/20100037765

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Distributed approaches for conflict resolution rely on analyzing the behavior of each aircraft to ensure that system-wide safety properties are maintained. This paper presents the criteria method, which increases the quality and efficiency of a safety assurance analysis for distributed air traffic concepts. The criteria standard is shown to provide two key safety properties: safe separation when only one aircraft maneuvers and safe separation when both aircraft maneuver at the same time. This approach is complemented with strong guarantees of correct operation through formal verification. To show that an algorithm is correct, i.e., that it always meets its specified safety property, one must only show that the algorithm satisfies the criteria. Once this is done, then the algorithm inherits the safety properties of the criteria. An important consequence of this approach is that there is no requirement that both aircraft execute the same conflict resolution algorithm. Therefore, the criteria approach allows different avionics manufacturers or even different airlines to use different algorithms, each optimized according to their own proprietary concerns.

Author

Air Traffic; Safety Factors; Program Verification (Computers); Systems Engineering; Avionics; Civil Aviation; Commercial Aircraft

20100037766 NASA Langley Research Center, Hampton, VA, USA

Time of Closest Approach in Three-Dimensional Airspace

Munoz, Cesar A.; Narkawicz, Anthony J.; October 2010; 19 pp.; In English

Contract(s)/Grant(s): WBS 411931.02.51.07.01

Report No.(s): NASA/TM-2010-216857; L-19933; NF1676L-11570

ONLINE: http://hdl.handle.net/2060/20100037766

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In air traffic management, the aircraft separation requirement is defined by a minimum horizontal distance and a minimum vertical distance that the aircraft have to maintain. Since this requirement defines a cylinder around each aircraft rather than a sphere, the three-dimensional Euclidean distance does not provide an appropriate basis for the definition of time of closest approach. For instance, conflicting aircraft are not necessarily in loss of separation at the time of closest three-dimensional Euclidean distance. This paper proposes a definition of time of closest approach that characterizes conflicts in a three-dimensional airspace. The proposed time is defined as the time that minimizes a distance metric called cylindrical norm.

An algorithm that computes the time of closest approach between two aircraft is provided and the formal verification of its main properties is reported.
Author
Air Traffic Control; Airspace; Euclidean Geometry; Algorithms; Three Dimensional Models

20100037776 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
An International Survey of Transport Airplane Pilots' Experiences and Perspectives of Lateral/Directional Control Events and Rudder Issues in Transport Airplanes (Rudder Survey)
Peterson, L. S.; Haworth, L. A.; Jones, R. C.; Newman, R. L.; McGuire, R. J.; Lambregts, A. A.; McCloy, T.; Chidester, T. R.; October 2010; 47 pp.; In English
Report No.(s): DOT/FAA/AM-10/14
No Copyright; Avail.: CASI

Following the AA587 accident, the National Transportation Safety Board requested that the FAA explore certain elements of transport aircraft and rudder usage, including but not limited to awareness that sequential full, opposite-rudder inputs (rudder reversals), even at speeds below the design maneuvering speed, may result in structural loads that exceed those addressed by Title 14 of the Code of Federal Regulations (CFR) part 25, 4 25.1507. The Transport Directorate initiated a Web-based survey developed in conjunction with the FAA Civil Aerospace Medical Institute to survey the population of Transport Category Airplane Pilots' (TCAP) understanding of the use of rudder and their experiences with rudder, both as the pilot Flying and as the pilot not flying. The survey also explored TCAP's experiences with upset, including magnitude and recovery. The survey further explored TCAP's experience with rudder training, unusual attitude recovery training, and their perceptions of additional training needed. Additionally, the survey explored the issue of maneuvering speed and movement of rudder, aileron, and elevator controls. Survey results indicated: 1) Rudder is reported to be used more than the Rudder Survey Team expected; 2) Rudder is reported to be used or considered for use in ways not always trained and in ways not recommended by the manufacturers; 3) Erroneous and accidental inputs occur, and it is reasonable to believe that this will continue in the future; 4) Some respondents reported making pedal reversals (cyclic rudder-pedal commands); 5) Some respondents are not clear on appropriate use of rudder, and many felt they needed more training; 6) Wake vortex encounters were reported to be the most common initiator of upset; these were most likely to be reported in the approach phase; and 7) Respondents did not seem to be concerned with differences among control system designs across aircraft. Given these findings, a set of recommendations is suggested to guide further research.
Author
Rudders; Transport Aircraft; Aircraft Safety; Aircraft Control; Pilot Training

20100037847
Homeland Security: US-VISIT Pilot Evaluations Offer Limited Understanding of Air Exit Options
August 2010; 82 pp.; In English
Report No.(s): PB2010-113239; GAO-10-860
No Copyright; Avail.: National Technical Information Service (NTIS)

The Department of Homeland Security's (DHS) U.S. Visitor and Immigrant Status Indicator Technology (US-VISIT) program is to control and monitor the entry and exit of foreign visitors by storing and processing biometric and biographic information. The entry capability has operated since 2006; an exit capability is not yet implemented. In September 2008, the Consolidated Security, Disaster Assistance, and Continuing Appropriations Act, 2009, directed DHS to pilot air exit scenarios with the U.S. Customs and Border Protection (CBP) and airlines, and to provide a report to congressional committees. DHS conducted CBP and Transportation Security Administration (TSA) pilots and issued its evaluation report in October 2009. Pursuant to the act, GAO reviewed the evaluation report to determine the extent to which (1) the report addressed statutory conditions and legislative directions; (2) the report aligned with the scope and approach in the pilot evaluation plan; (3) the pilots were conducted in accordance with the evaluation plan; and (4) the evaluation plan satisfied relevant guidance. To do so, GAO compared the report to statutory conditions, the evaluation plan, and relevant guidance.
NTIS
Airline Operations; Civil Aviation; Commercial Aircraft; Security

20100037920 California Univ., Santa Cruz, CA, USA

Three Dimensional Sector Design with Optimal Number of Sectors

Xue, Min; October 13, 2009; 28 pp.; In English; NASA's Technical Interchange Meeting and NextGen System Study NRA Workshop, 13-16 Oct. 2009, San Antonio, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS0203144

Report No.(s): ARC-E-DAA-TN903

ONLINE: http://hdl.handle.net/2060/20100037920

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The concept of dynamic sector design suggests a strategic approach to ease air traffic congestion, which is predicted to become a serious problem in the national airspace system by 2025. Considerable research has been conducted to address the sectorization problem. In previous work, an approach that combines the Voronoi diagrams, Genetic Algorithms (GA), and the iterative deepening algorithm was proposed. However, as originally formulated, the number of sectors used was predefined and only two-dimensional partitions were allowed, which constrained the method's ability to achieve good designs. The current work extends the earlier Voronoi-based method by treating the number of sectors as an additional decision variable, allowing 3D partitions, and developing more comprehensive costs.

Author

Air Traffic Control; Genetic Algorithms; National Airspace System; Iteration; Sectors

20100038317 NASA Ames Research Center, Moffett Field, CA, USA

A Terminal Area Analysis of Continuous Ascent Departure Fuel Use at Dallas/Fort Worth International Airport

Roach, Keenan; Robinson, John E., III; September 13, 2010; 11 pp.; In English; 10th AIAA Aviation Technology, Integration, and Operations (ATIO) Conference, 13-15 Sep. 2010, Fort Worth, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS2-03144

Report No.(s): ARC-E-DAA-TN2060

ONLINE: http://hdl.handle.net/2060/20100038317

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Aircraft departing from the Dallas/Fort Worth International Airport (DFW) encounter vertical restrictions that prevent continuous ascent operations. The result of these restrictions are temporary level-offs at 10,000 feet. A combination of flow direction, specific Area Navigation (RNAV) route geometry, and arrival streams have been found to be the biggest factors in the duration and frequency of a temporary level-offs. In total, 20% of DFW departures are affected by these level-offs, which have an average duration of just over 100 seconds. The use of continuous descent approaches at DFW are shown to lessen the impact arrivals have on the departures and allow more continuous ascents. The fuel used in a continuous ascent and an ascent with a temporary level-off have been calculated using a fuel burn rate model created from a combination of actual aircraft track data, aircraft manufacturer flight operations manuals, and Eurocontrol's Base of Aircraft Data (BADA) simulation tool. This model represents the average aggregate burn rates for the current fleet mix at DFW. Continuous ascents would save approximately seven gallons of fuel out of 450 gallons used to climb to a cruise altitude of 31,000ft per departure.

Author

Ascent; Flight Operations; Airports; Aircraft Fuels; Air Transportation

20100038318 NASA Ames Research Center, Moffett Field, CA, USA

Fuel Efficient Strategies for Reducing Contrail Formations in USA Air Space

Sridhar, Banavar; Chen, Neil Y.; Ng, Hok K.; October 03, 2010; 9 pp.; In English; 29th Digital Avionics Systems Conference: Improving Our Environment Through Green Avionics and ATM Solutions, 3-7 Oct. 2010, Salt Lake City, UT, USA; Original contains color illustrations

Contract(s)/Grant(s): NNAS203144; WBS 411931.02.41.01.03

Report No.(s): ARC-E-DAA-TN2066

ONLINE: http://hdl.handle.net/2060/20100038318

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This paper describes a class of strategies for reducing persistent contrail formation in the USA airspace. The primary objective is to minimize potential contrail formation regions by altering the aircraft's cruising altitude in a fuel-efficient way. The results show that the contrail formations can be reduced significantly without extra fuel consumption and without adversely affecting congestion in the airspace. The contrail formations can be further reduced by using extra fuel. For the day tested, the maximal reduction strategy has a 53% contrail reduction rate. The most fuel-efficient strategy has an 8% reduction rate with 2.86% less fuel-burnt compared to the maximal reduction strategy. Using a cost function which penalizes extra fuel

consumed while maximizing the amount of contrail reduction provides a flexible way to trade off between contrail reduction and fuel consumption. It can achieve a 35% contrail reduction rate with only 0.23% extra fuel consumption. The proposed fuel-efficient contrail reduction strategy provides a solution to reduce aviation-induced environmental impact on a daily basis. Author

Airspace; Fuel Consumption; Contrails

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications, Spacecraft Communications, Command and Tracking; and 32 Communications and Radar.

20100037234 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

U.S. Airline Transport Pilot International Flight Language Experiences Report 4: Non-Native English-Speaking Controllers Communication with Native English-Speaking Pilots

Prinzo, O. Veronika; Campbell, Alan; Hendrix, Alfred M.; Hendrix, Ruby; August 2010; 41 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): AM-B-06-HRR-516

Report No.(s): DOT/FAAJAM-10/12

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In 1998, the International Civil Aviation Organization (ICAO) took a heightened interest in the role of language in airline accidents. Member states agreed to take steps to ensure air traffic control (ATC) personnel and flight crews involved in flight operations in airspace where the use of the English language is required were proficient in conducting and comprehending radiotelephony communications in English. This report is a compilation of responses and comments by a group of U.S. pilots from American, Continental, Delta, and United Airlines of their difficulties in international operations. In this report, their responses to questions 39-45 are presented as a compiled narrative. We derived six major thrusts: (1) The English language proficiency of non-native English-speaking controllers may be inadequate for high workload conditions; (2) Pilots develop and use different strategies to improve ATC communications once they determine the controller's language proficiency; (3) Pilots describe ATC communications between users of the same and different languages; (4) Language switching distracts pi lots and limits understanding, adversely affects situational awareness, leaves them with feelings of uncertainty, and increases their workload; (5) Language barriers most affect situational awareness just prior to top-of- descent and during taxi; and (6) How pilots compensate for reductions in situational awareness. We offer 16 recommendations to improve communication practices ranging from developing standardized and secure English language testing for use by all ICAO member states, to realistic emergency and nonroutine scenarios and simulations demonstrating use of conversational English to enhance datalink for surveillance and communications.

Author

Airline Operations; Civil Aviation; Commercial Aircraft; English Language; Aircraft Pilots; Air Traffic Control; Voice Communication

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance and evaluation, and aircraft and flight simulation technology. For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles see 85 Technology Utilization and Surface Transportation.

20100036930 NASA Ames Research Center, Moffett Field, CA, USA

Control of Next Generation Aircraft and Wind Turbines

Frost, Susan; April 29, 2010; 41 pp.; In English; Collaboration Meeting with NREL and University of Wyoming, 29 Apr. 2010, Golden, CO, USA; Original contains color illustrations

Report No.(s): ARC-E-DAA-TN1505

ONLINE: http://hdl.handle.net/2060/20100036930

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The first part of this talk will describe some of the exciting new next generation aircraft that NASA is proposing for the

future. These aircraft are being designed to reduce aircraft fuel consumption and environmental impact. Reducing the aircraft weight is one approach that will be used to achieve these goals. A new control framework will be presented that enables lighter, more flexible aircraft to maintain aircraft handling qualities, while preventing the aircraft from exceeding structural load limits. The second part of the talk will give an overview of utility-scale wind turbines and their control. Results of collaboration with Dr. Balas will be presented, including new theory to adaptively control the turbine in the presence of structural modes, with the focus on the application of this theory to a high-fidelity simulation of a wind turbine.
Author
Wind Turbines; Aircraft Stability; Aircraft Design; Loads (Forces)

20100037081 NASA Dryden Flight Research Center, Edwards, CA, USA
Limits to Open Class Performance?
Bowers, Al; May 15, 2010; 35 pp.; In English; Mountain Wave Clinic, 15 May 2010, Pearblossom, CA, USA; Original contains color illustrations
Report No.(s): DFRC-E-DAA-TN1653
ONLINE: http://hdl.handle.net/2060/20100037081
No Copyright; Avail.: CASI
An oral/visual presentation sharing aspects of open class performance limits.
Author
Aircraft Design; Aircraft Performance; Structural Weight; Technology Utilization; Aircraft Structures

20100037184 NASA Dryden Flight Research Center, Edwards, CA, USA
2008 and 2009 Research and Engineering Annual Report
Flick, Bradley C.; Voracek, David F.; May 2010; 50 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TM-2010-214655; H-3027; DFRC-E-DAA-TN1668
ONLINE: http://hdl.handle.net/2060/20100037184
No Copyright; Avail.: CASI
Selected research and technology activities at NASA Dryden Flight Research Center are summarized. These activities exemplify the Center's varied and productive research efforts.
Author
Research and Development; Flutter; Aeroservoelasticity; Aircraft Structures; Flight Tests; Computational Fluid Dynamics; Control Surfaces

20100037833
High Spectral Resolution Infrared and Raman Lidar Observations for the ARM Program: Clear and Cloudy Sky Applications, (Final Report)
Revercomb, H.; Tobin, D.; Knuteson, R.; Borg, L.; Moy, L.; June 17, 2009; 46 pp.; In English
Contract(s)/Grant(s): DE-FG02-90ER61057
Report No.(s): DE2010-957049; DOE/ER/61057-FINAL
No Copyright; Avail.: National Technical Information Service (NTIS)
This grant began with the development of the Atmospheric Emitted Radiance Interferometer (AERI) for ARM. The AERI has provided highly accurate and reliable observations of downwelling spectral radiance (Knuteson et al. 2004a, 2004b) for application to radiative transfer, remote sensing of boundary layer temperature and water vapor, and cloud characterization. One of the major contributions of the ARM program has been its success in improving radiation calculation capabilities for models and remote sensing that evolved from the multi-year, clear-sky spectral radiance comparisons between AERI radiances and line-by-line calculations (Turner et al. 2004). This effort also spurred us to play a central role in improving the accuracy of water vapor measurements, again helping ARM lead the way in the community (Turner et al. 2003a, Revercomb et al. 2003). In order to add high-altitude downlooking AERI-like observations over the ARM sites, we began the development of

an airborne AERI instrument that has become known as the Scanning High-resolution Interferometer Sounder (Scanning-HIS). This instrument has become an integral part of the ARM Unmanned Aerospace Vehicle (ARM-UAV) program. It provides both a cross-track mapping view of the earth and an uplooking view from the 12-15 km altitude of the Scaled Composites Proteus aircraft when flown over the ARM sites for IOPs. It has successfully participated in the first two legs of the grand tour of the ARM sites (SGP and NSA), resulting in a very good comparison with AIRS observations in 2002 and in an especially interesting data set from the arctic during the Mixed-Phase Cloud Experiment (M-PACE) in 2004.
NTIS
Clearing; High Resolution; Infrared Radar; Spectral Resolution

20100037841
Development of Autonomous Magnetometer Rotorcraft for Wide Area Assessment
Verstegg, R.; Anderson, M.; Beard, L.; Corban, E.; Curley, D.; April 2010; 59 pp.; In English
Contract(s)/Grant(s): DE-AC07-05ID14517
Report No.(s): DE2010-978361; INL/EXT-10-18291
No Copyright; Avail.: National Technical Information Service (NTIS)

Large areas across the USA are potentially contaminated with UXO, with some ranges encompassing tens to hundreds of thousands of acres. Technologies are needed which will allow for cost effective wide area scanning with (1) near 100 % coverage and (2) near 100 % detection of subsurface ordnance or features indicative of subsurface ordnance. The current approach to wide area assessment is a multi-level one, in which medium - altitude fixed wing optical imaging is used for an initial site assessment. This assessment is followed with low altitude manned helicopter based magnetometry. In order to be an effective tool for small UXO detection, the sensing altitude for magnetic site investigations needs to be on the order of 1 - 3 meters. These altitude requirements mean that manned helicopter surveys will generally only be feasible in large, open and relatively flat terrains. While such surveys are effective in mapping large areas relatively fast there are substantial mobilization/demobilization, staffing and equipment costs associated with these surveys (resulting in costs of approximately $100-$150/acre). In addition, due to the low altitude there are substantial risks to pilots and equipment. Surface towed arrays provide high resolution maps but have other limitations, e.g. in their ability to navigate rough terrain effectively. There is thus a need for other systems which can be used for effective data collection.
NTIS
Autonomy; Magnetometers; Ordnance; Rotary Wing Aircraft

20100038316 NASA Ames Research Center, Moffett Field, CA, USA
Effect of Conflict Resolution Maneuver Execution Delay on Losses of Separation
Cone, Andrew C.; October 03, 2010; 14 pp.; In English; 29th Digital Avionics Systems Conference: Improving Our Environment Through Green Avionics and ATM Solutions, 3-7 Oct. 2010, Salt Lake City, UT, USA; Original contains black and white illustrations
Report No.(s): ARC-E-DAA-TN2058
ONLINE: http://hdl.handle.net/2060/20100038316
No Copyright; Avail.: CASI

This paper examines uncertainty in the maneuver execution delay for data linked conflict resolution maneuvers. This uncertainty could cause the previously cleared primary conflict to reoccur or a secondary conflict to appear. Results show that the likelihood of a primary conflict reoccurring during a horizontal conflict resolution maneuver increases with larger initial turn-out angles and with shorter times until loss of separation. There is also a significant increase in the probability of a primary conflict reoccurring when the time until loss falls under three minutes. Increasing horizontal separation by an additional 1.5 nmi lowers the risk, but does not completely eliminate it. Secondary conflicts were shown to have a small probability of occurring in all tested configurations.
Author
Data Links; Air Transportation; Delay; Simulation; Aircraft Maneuvers

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

Includes all avionics systems, cockpit and cabin display devices, and flight instruments intended for use in aircraft. For related information see also 04 Aircraft Communications and Navigation; 08 Aircraft Stability and Control; 19 Spacecraft Instrumentation and Astrionics; and 35 Instrumentation and Photography.

20100038315 NASA Ames Research Center, Moffett Field, CA, USA

Analysis of Flight Management System Predictions of Idle-Thrust Descents

Stell, Laurel; October 03, 2010; 15 pp.; In English; 29th Digital Avionics Systems Conference: Improving Our Environment Through Green Avionics and ATM Solution, 3-7 Oct. 2010, Salt Lake City, UT, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 411931.02.51.01.25

Report No.(s): ARC-E-DAA-TN2053

ONLINE: http://hdl.handle.net/2060/20100038315

No Copyright; Avail.: CASI

To enable arriving aircraft to fly optimized descents computed by the flight management system (FMS) in congested airspace, ground automation must accurately predict descent trajectories. To support development of the predictor and its uncertainty models, descents from cruise to the meter fix were executed using vertical navigation in a B737-700 simulator and a B777-200 simulator, both with commercial FMSs. For both aircraft types, the FMS computed the intended descent path for a specified speed profile assuming idle thrust after top of descent (TOD), and then it controlled the avionics without human intervention. The test matrix varied aircraft weight, descent speed, and wind conditions. The first analysis in this paper determined the effect of the test matrix parameters on the FMS computation of TOD location, and it compared the results to those for the current ground predictor in the Efficient Descent Advisor (EDA). The second analysis was similar but considered the time to fly a specified distance to the meter fix. The effects of the test matrix variables together with the accuracy requirements for the predictor will determine the allowable error for the predictor inputs. For the B737, the EDA prediction of meter fix crossing time agreed well with the FMS; but its prediction of TOD location probably was not sufficiently accurate to enable idle-thrust descents in congested airspace, even though the FMS and EDA gave similar shapes for TOD location as a function of the test matrix variables. For the B777, the FMS and EDA gave different shapes for the TOD location function, and the EDA prediction of the TOD location is not accurate enough to fully enable the concept. Furthermore, the differences between the FMS and EDA predictions of meter fix crossing time for the B777 indicated that at least one of them was not sufficiently accurate.
Author

Airspace; Avionics; Descent Trajectories; Flight Management Systems; Thrust; Boeing 737 Aircraft; Boeing 777 Aircraft

07
AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power; 28 Propellants and Fuels; and 44 Energy Production and Conversion.

20100037204 NASA Glenn Research Center, Cleveland, OH, USA

Optical Characterization of a Multipoint Lean Direct Injector for Gas Turbine Combustors: Velocity and Fuel Drop Size Measurements

Heath, Christopher M.; Anderson, Robert C.; Locke, Randy J.; Hicks, Yolanda R.; October 2010; 20 pp.; In English; ASME Turbo Expo 2010/International Gas Turbine Institute, 14-18 Jun. 2010, Glasgow, Scotland, UK; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 56181.02.08.03.16.03

Report No.(s): NASA/TM-2010-216365; E-17301

ONLINE: http://hdl.handle.net/2060/20100037204

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Performance of a multipoint, lean direct injection (MP-LDI) strategy for low emission aero-propulsion systems has been tested in a Jet-A fueled, lean flame tube combustion rig. Operating conditions for the series of tests included inlet air temperatures between 672 and 828 K, pressures between 1034 and 1379 kPa and total equivalence ratios between 0.41 and 0.45, resulting in equilibrium flame temperatures approaching 1800 K. Ranges of operation were selected to represent the spectrum of subsonic and supersonic flight conditions projected for the next-generation of commercial aircraft. This document

reports laser-based measurements of in situ fuel velocities and fuel drop sizes for the NASA 9-point LDI hardware arranged in a 3 3 square grid configuration. Data obtained represent a region of the flame tube combustor with optical access that extends 38.1-mm downstream of the fuel injection site. All data were obtained within reacting flows, without particle seeding. Two diagnostic methods were employed to evaluate the resulting flow path. Three-component velocity fields have been captured using phase Doppler interferometry (PDI), and two-component velocity distributions using planar particle image velocimetry (PIV). Data from these techniques have also offered insight into fuel drop size and distribution, fuel injector spray angle and pattern, turbulence intensity, degree of vaporization and extent of reaction. This research serves to characterize operation of the baseline NASA 9- point LDI strategy for potential use in future gas-turbine combustor applications. An additional motive is the compilation of a comprehensive database to facilitate understanding of combustor fuel injector aerodynamics and fuel vaporization processes, which in turn may be used to validate computational fluid dynamics codes, such as the National Combustor Code (NCC), among others.
Author
Fuel Injection; Gas Turbines; Flight Conditions; Computational Fluid Dynamics; Combustion Chambers; Aircraft Engines; Flame Temperature; Inlet Temperature; Supersonic Flight

20100037767 NASA Glenn Research Center, Cleveland, OH, USA
A High-Fidelity Simulation of a Generic Commercial Aircraft Engine and Controller
May, Ryan D.; Csank, Jeffrey; Lavelle, Thomas M.; Litt, Jonathan S.; Guo, Ten-Huei; October 2010; 23 pp.; In English; 46th Joint Propulsion Conference and Exhibit, 25-28 Jul. 2010, Nashville, TN, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 457280,02,07,03-03,01
Report No.(s): NASA/TM-2010-216810; AIAA Paper 2010-6630; E-17442
ONLINE: http://hdl.handle.net/2060/20100037767
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A new high-fidelity simulation of a generic 40,000 lb thrust class commercial turbofan engine with a representative controller, known as CMAPSS40k, has been developed. Based on dynamic flight test data of a highly instrumented engine and previous engine simulations developed at NASA Glenn Research Center, this non-proprietary simulation was created especially for use in the development of new engine control strategies. C-MAPSS40k is a highly detailed, component-level engine model written in MATLAB/Simulink (The MathWorks, Inc.). Because the model is built in Simulink, users have the ability to use any of the MATLAB tools for analysis and control system design. The engine components are modeled in C-code, which is then compiled to allow faster-than-real-time execution. The engine controller is based on common industry architecture and techniques to produce realistic closed-loop transient responses while ensuring that no safety or operability limits are violated. A significant feature not found in other non-proprietary models is the inclusion of transient stall margin debits. These debits provide an accurate accounting of the compressor surge margin, which is critical in the design of an engine controller. This paper discusses the development, characteristics, and capabilities of the C-MAPSS40k simulation
Author
Turbofan Engines; Control Systems Design; Engine Control; Feedback Control; Flight Tests; Real Time Operation

20100037768 NASA Glenn Research Center, Cleveland, OH, USA
Control Design for a Generic Commercial Aircraft Engine
Csank, Jeffrey; May, Ryan D.; October 2010; 24 pp.; In English; 46th Joint Propulsion Conference and Exhibit, 25-28 Jul. 2010, Nashville, TN, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 457280.02.07.03.03.01
Report No.(s): NASA/TM-2010-216811; AIAA Paper 2010-6629; E-17443
ONLINE: http://hdl.handle.net/2060/20100037768
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This paper describes the control algorithms and control design process for a generic commercial aircraft engine simulation of a 40,000 lb thrust class, two spool, high bypass ratio turbofan engine. The aircraft engine is a complex nonlinear system designed to operate over an extreme range of environmental conditions, at temperatures from approximately -60 to 120+ F, and at altitudes from below sea level to 40,000 ft, posing multiple control design constraints. The objective of this paper is to provide the reader an overview of the control design process, design considerations, and justifications as to why the

particular architecture and limits have been chosen. The controller architecture contains a gain-scheduled Proportional Integral controller along with logic to protect the aircraft engine from exceeding any limits. Simulation results illustrate that the closed loop system meets the Federal Aviation Administration s thrust response requirements
Author
Feedback Control; Turbofan Engines; Design Analysis; Complex Systems; Ambient Temperature; Controllers

08
AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also 05 Aircraft Design, Testing and Performance; and 06 Avionics and Aircraft Instrumentation.

20100036719 NASA Ames Research Center, Moffett Field, CA, USA
Hybrid Decompositional Verification for Discovering Failures in Adaptive Flight Control Systems
Thompson, Sarah; Davies, Misty D.; Gundy-Burlet, Karen; April 20, 2010; 8 pp.; In English; AIAA Infotech at Aerospace 2010, 20-22 Apr. 2010, Atlanta, GA, USA; Original contains color illustrations
Contract(s)/Grant(s): NNA08CG83C
Report No.(s): ARC-E-DAA-TN1542
ONLINE: http://hdl.handle.net/2060/20100036719
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Adaptive flight control systems hold tremendous promise for maintaining the safety of a damaged aircraft and its passengers. However, most currently proposed adaptive control methodologies rely on online learning neural networks (OLNNs), which necessarily have the property that the controller is changing during the flight. These changes tend to be highly nonlinear, and difficult or impossible to analyze using standard techniques. In this paper, we approach the problem with a variant of compositional verification. The overall system is broken into components. Undesirable behavior is fed backwards through the system. Components which can be solved using formal methods techniques explicitly for the ranges of safe and unsafe input bounds are treated as white box components. The remaining black box components are analyzed with heuristic techniques that try to predict a range of component inputs that may lead to unsafe behavior. The composition of these component inputs throughout the system leads to overall system test vectors that may elucidate the undesirable behavior
Author
Adaptive Control; Flight Control; Failure Analysis; F-15 Aircraft; Heuristic Methods

20100036789 NASA Ames Research Center, Moffett Field, CA, USA
Verifiable Adaptive Control with Analytical Stability Margins by Optimal Control Modification
Nguyen, Nhan T.; August 02, 2010; 15 pp.; In English; 2010 AIAA Guidance, Navigation, and Control Conference, 2-5 Aug. 2010, Toronto, Ontario, Canada, Canada; Original contains color illustrations
Contract(s)/Grant(s): WBS 457280.02.07.01.02.01
Report No.(s): ARC-E-DAA-TN1962
ONLINE: http://hdl.handle.net/2060/20100036789
No Copyright; Avail.: CASI

This paper presents a verifiable model-reference adaptive control method based on an optimal control formulation for linear uncertain systems. A predictor model is formulated to enable a parameter estimation of the system parametric uncertainty. The adaptation is based on both the tracking error and predictor error. Using a singular perturbation argument, it can be shown that the closed-loop system tends to a linear time invariant model asymptotically under an assumption of fast adaptation. A stability margin analysis is given to estimate a lower bound of the time delay margin using a matrix measure method. Using this analytical method, the free design parameter n of the optimal control modification adaptive law can be determined to meet a specification of stability margin for verification purposes.
Author
Adaptive Control; Feedback Control; Stability Tests; Uncertain Systems; Linear Systems; Parameter Identification; Perturbation; Optimal Control; Model Reference Adaptive Control

20100037191 NASA Dryden Flight Research Center, Edwards, CA, USA
NASA Dryden Status
Jacobson, Steven R.; March 2010; 8 pp.; In English; Aerospace Control and Guidance Sub-committee Meeting, 4 Mar. 2010, Lake Tahoe, NV, USA; Original contains color illustrations
Report No.(s): DFRC-E-DAA-TN1297
ONLINE: http://hdl.handle.net/2060/20100037191
No Copyright; Avail.: CASI

Conference presentation sharing NASA Dryden status.

Author
F-18 Aircraft; Test Stands; Aircraft Design; Aerospace Engineering; Adaptive Control; Flight Tests

20100037212 NASA Dryden Flight Research Center, Edwards, CA, USA
L1 Adaptive Control Augmentation System with Application to the X-29 Lateral/Directional Dynamics: A Multi-Input Multi-Output Approach
Griffin, Brian Joseph; Burken, John J.; Xargay, Enric; July 14, 2010; 14 pp.; In English; AIAA Guidance, Navigation, and Control Conference, 2-5 Aug. 2010, Toronto, Ontario, Canada, Canada; Original contains color illustrations
Report No.(s): DFRC-E-DAA-TN1776
ONLINE: http://hdl.handle.net/2060/20100037212
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This paper presents an L(sub 1) adaptive control augmentation system design for multi-input multi-output nonlinear systems in the presence of unmatched uncertainties which may exhibit significant cross-coupling effects. A piecewise continuous adaptive law is adopted and extended for applicability to multi-input multi-output systems that explicitly compensates for dynamic cross-coupling. In addition, explicit use of high-fidelity actuator models are added to the L1 architecture to reduce uncertainties in the system. The L(sub 1) multi-input multi-output adaptive control architecture is applied to the X-29 lateral/directional dynamics and results are evaluated against a similar single-input single-output design approach.

Author
Adaptive Control; Augmentation; X-29 Aircraft; MIMO (Control Systems); Systems Engineering

20100037973 NASA Ames Research Center, Moffett Field, CA, USA
Optimal Control Modification for Robust Adaptation of Singularly Perturbed Systems with Slow Actuators
Nguyen, Nhan T.; Ishihara, Abraham; Stepanyan, Vahram; Boskovic, Jovan; August 10, 2009; 21 pp.; In English; 2009 AIAA Guidance, Navigation, and Control Conference, 10-13 Aug. 2009, Chicago, IL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNA08CG83C; WBS 457280.02.07.01.02.01
Report No.(s): ARC-E-DAA-TN781
ONLINE: http://hdl.handle.net/2060/20100037973
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Recently a new optimal control modification has been introduced that can achieve robust adaptation with a large adaptive gain without incurring high-frequency oscillations as with the standard model-reference adaptive control. This modification is based on an optimal control formulation to minimize the L2 norm of the tracking error. The optimal control modification adaptive law results in a stable adaptation in the presence of a large adaptive gain. This study examines the optimal control modification adaptive law in the context of a system with a time scale separation resulting from a fast plant with a slow actuator. A singular perturbation analysis is performed to derive a modification to the adaptive law by transforming the original system into a reduced-order system in slow time. The model matching conditions in the transformed time coordinate results in increase in the feedback gain and modification of the adaptive law.

Author
Optimal Control; Perturbation; Singularity (Mathematics); Actuators; Revisions; Aircraft Control

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronautical facilities see *14 Ground Support Systems and Facilities (Space)*.

20100037223 NASA Stennis Space Center, Stennis Space Center, MS, USA

Integrated System Health Management (ISHM) Implementation in Rocket Engine Testing

Figueroa, Fernando; Morris, Jon; Turowski, Mark; Franzl, Richard; Walker, Mark; Kapadia, Ravi; Venkatesh, Meera; [2010]; 1 pp.; In English; AIAA Infotech\@Aerospace 2011, 29-31 Mar. 2011, Saint Louis, MO, USA

Contract(s)/Grant(s): NNS10332878Q

Report No.(s): SSTI-2200-0117

ONLINE: http://hdl.handle.net/2060/20100037223

Copyright; Distribution as joint owner in the copyright; Avail.: CASI; Abstract Only

A pilot operational ISHM capability has been implemented for the E-2 Rocket Engine Test Stand (RETS) and a Chemical Steam Generator (CSG) test article at NASA Stennis Space Center. The implementation currently includes an ISHM computer and a large display in the control room. The paper will address the overall approach, tools, and requirements. It will also address the infrastructure and architecture. Specific anomaly detection algorithms will be discussed regarding leak detection and diagnostics, valve validation, and sensor validation. It will also describe development and use of a Health Assessment Database System (HADS) as a repository for measurements, health, configuration, and knowledge related to a system with ISHM capability. It will conclude with a discussion of user interfaces, and a description of the operation of the ISHM system prior, during, and after testing.

Author

Systems Integration; Test Stands; E-2 Aircraft; Rocket Engine Design; Systems Health Monitoring

20100037225 NASA Stennis Space Center, Stennis Space Center, MS, USA

AIAA Aerospace America Magazine - Year in Review Article, 2010

Figueroa, Fernando; AIAA Aerospace America Magazine - Year in Review Article, 2010; [2010]; 1 pp.; In English; Original contains color illustrations

Report No.(s): SSTI-2200-0119

ONLINE: http://hdl.handle.net/2060/20100037225

No Copyright; Avail.: CASI

NASA Stennis Space Center has implemented a pilot operational Integrated System Health Management (ISHM) capability. The implementation was done for the E-2 Rocket Engine Test Stand and a Chemical Steam Generator (CSG) test article; and validated during operational testing. The CSG test program is a risk mitigation activity to support building of the new A-3 Test Stand, which will be a highly complex facility for testing of engines in high altitude conditions. The foundation of the ISHM capability are knowledge-based integrated domain models for the test stand and CSG, with physical and model-based elements represented by objects the domain models enable modular and evolutionary ISHM functionality.

Author

Systems Integration; Systems Health Monitoring; Knowledge Based Systems; Rocket Engines; Test Stands

12
ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration see *91 Lunar and Planetary Science and Exploration*.

20100037210 NASA Glenn Research Center, Cleveland, OH, USA

Interplanetary Mission Design Handbook: Earth-to-Mars Mission Opportunities 2026 to 2045

Burke, Laura M.; Falck, Robert D.; McGuire, Melissa L.; October 2010; 94 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 22-973-40-06; WBS 22-800-90-A9

Report No.(s): NASA/TM-2010-216764; E-17208

ONLINE: http://hdl.handle.net/2060/20100037210

No Copyright; Avail.: CASI

The purpose of this Mission Design Handbook is to provide trajectory designers and mission planners with graphical information about Earth to Mars ballistic trajectory opportunities for the years of 2026 through 2045. The plots, displayed on a departure date/arrival date mission space, show departure energy, right ascension and declination of the launch asymptote, and target planet hyperbolic arrival excess speed, V(sub infinity), for each launch opportunity. Provided in this study are two sets of contour plots for each launch opportunity. The first set of plots shows Earth to Mars ballistic trajectories without the addition of any deep space maneuvers. The second set of plots shows Earth to Mars transfer trajectories with the addition of deep space maneuvers, which further optimize the determined trajectories. The accompanying texts explains the trajectory characteristics, transfers using deep space maneuvers, mission assumptions and a summary of the minimum departure energy for each opportunity.

Author

Trajectories; Launching; Mission Planning; Asymptotes; Targets; Deep Space; Handbooks; Ballistic Trajectories

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air)*.

20100036815 NASA Kennedy Space Center, Cocoa Beach, FL, USA

KSC Technical Capabilities Website

Nufer, Brian; Bursian, Henry; Brown, Laurette L.; [2010]; 132 pp.; In English; Original contains color illustrations

Report No.(s): KSC-2010-232

ONLINE: http://hdl.handle.net/2060/20100036815

No Copyright; Avail.: CASI

This document is the website pages that review the technical capabilities that the Kennedy Space Center (KSC) has for partnership opportunities. The purpose of this information is to make prospective customers aware of the capabilities and provide an opportunity to form relationships with the experts at KSC. The technical capabilities fall into these areas: (1) Ground Operations and Processing Services, (2) Design and Analysis Solutions, (3) Command and Control Systems / Services, (4) Materials and Processes, (5) Research and Technology Development and (6) Laboratories, Shops and Test Facilities.

CASI

Research and Development; Test Facilities; Research Facilities; NASA Programs; Technology Utilization; Technology Transfer; Commercialization; Government/Industry Relations

20100037919 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Statistical and Probabilistic Extensions to Ground Operations' Discrete Event Simulation Modeling

Trocine, Linda; Cummings, Nicholas H.; Bazzana, Ashley M.; DES Modeling and Analysis Center; LeCroy, Kenneth L.; Cates, Grant R.; April 25, 2010; 10 pp.; In English; SpaceOps 2010 Conference, 25-30 Apr. 2010, Huntsville, AL, USA; Original contains color illustrations

Contract(s)/Grant(s): NNK09EA11C
Report No.(s): KSC-2010-033R
ONLINE: http://hdl.handle.net/2060/20100037919

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NASA's human exploration initiatives will invest in technologies, public/private partnerships, and infrastructure, paving the way for the expansion of human civilization into the solar system and beyond. As it is has been for the past half century, the Kennedy Space Center will be the embarkation point for humankind's journey into the cosmos. Functioning as a next generation space launch complex, Kennedy's launch pads, integration facilities, processing areas, launch and recovery ranges will bustle with the activities of the world's space transportation providers. In developing this complex, KSC teams work through the potential operational scenarios: conducting trade studies, planning and budgeting for expensive and limited resources, and simulating alternative operational schemes. Numerous tools, among them discrete event simulation (DES), were matured during the Constellation Program to conduct such analyses with the purpose of optimizing the launch complex for maximum efficiency, safety, and flexibility while minimizing life cycle costs. Discrete event simulation is a computer-based modeling technique for complex and dynamic systems where the state of the system changes at discrete points in time and whose inputs may include random variables. DES is used to assess timelines and throughput, and to support operability studies and contingency analyses. It is applicable to any space launch campaign and informs decision-makers of the effects of varying numbers of expensive resources and the impact of off nominal scenarios on measures of performance. In order to develop representative DES models, methods were adopted, exploited, or created to extend traditional uses of DES. The Delphi method was adopted and utilized for task duration estimation. DES software was exploited for probabilistic event variation. A roll-up process was used, which was developed to reuse models and model elements in other less - detailed models. The DES team continues to innovate and expand DES capabilities to address KSC's planning needs.
Author

Ground Operational Support System; Probability Distribution Functions; Spacecraft Launching; Delphi Method (Forecasting); Computer Techniques; Complex Systems; Life Cycle Costs; Discrete Functions; Space Transportation

15
LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing and Performance*; and *20 Spacecraft Propulsion and Power*.

20100036816 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Expendable Launch Vehicles Briefing and Basic Rocketry Physics

Delgado, Luis G.; August 2010; 48 pp.; In English; Original contains color illustrations

Report No.(s): KSC-2010-233
ONLINE: http://hdl.handle.net/2060/20100036816

No Copyright; Avail.: CASI

This slide presentation is composed of two parts. The first part shows pictures of launch vehicles and lift offs or in the case of the Pegasus launch vehicle separations. The second part discusses the basic physics of rocketry, starting with Newton's three physical laws that form the basis for classical mechanics. It includes a review of the basic equations that define the physics of rocket science, such as total impulse, specific impulse, effective exhaust velocity, mass ratio, propellant mass fraction, and the equations that combine to arrive at the thrust of the rocket. The effect of atmospheric pressure is reviewed, as is the effect of propellant mix on specific impulse.
CASI

Classical Mechanics; Launch Vehicles; Rocket Engines; Rocket Vehicles; Rocket Launching; Rocket Launchers; Spacecraft Launching; Liftoff (Launching); Rocket Firing

20100037917 NASA Kennedy Space Center, Cocoa Beach, FL, USA
External Payload Carrier (XPC) - A Novel Platform for Suborbital Research
Schallhorn, Paul; Groves, Curtis; Tatro, Charles; Kutter, Bernard; Szatkowski, Gerald; Bulk, Tim; Pitchford, Brian; February 18, 2010; 14 pp.; In English; Next Generation Suborbital Researchers Conference, 18-20 Feb. 2010, Boulder, CO, USA; Original contains black and white illustrations
Report No.(s): KSC-2010-026
ONLINE: http://hdl.handle.net/2060/20100037917
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ULA, SAS, and NASA LSP are examining a new platform for suborbital research utilizing the Atlas V Launch Vehicle. The new platform, XPC, fills a new niche within the suborbital realm Large Heavy Lift (approximately 1200 cubic feet, 5000 lb payload). It will not compete with the commercial suborbital launch sector. The XPC will utilize excess performance on Atlas V missions. The Preliminary Design phase is recently underway. The XPC team is soliciting input from potential users. Derived from text
Payloads; Atlas Able 5 Launch Vehicle; Suborbital Flight; Space Platforms

16
SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety; 15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

20100036729 Jacobs Engineering Group, Inc., Houston, TX, USA
Orion Launch Abort Vehicle Separation Analysis Using OVERFLOW
Booth, Tom; September 20, 2010; 20 pp.; In English; 10th Symposium on Overset Composite Grids and Solution Technology, 20-23 Sep. 2010, Moffett Field, CA, USA; Original contains color illustrations
Report No.(s): JSC-CN-21698
ONLINE: http://hdl.handle.net/2060/20100036729
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This slide presentation reviews the use of OVERFLOW, a flow solver, to analyze the effect of separation for a launch abort vehicle (i.e., Orion capsule) if required. Included in the presentation are views of the geometry, and the Overset grids, listing of the assumptions, the general run strategy, inputs into the Overflow solver, the required computational resources, the results of the convergence study. Charts and graphics are presented to show the results.
CASI
Abort Apparatus; Spacecraft Launching; Computational Fluid Dynamics; Crew Exploration Vehicle

20100036751 NASA Kennedy Space Center, Cocoa Beach, FL, USA
World, We Have Problems: Simulation for Large Complex, Risky Projects, and Events
Elfrey, Priscilla; [2010]; 9 pp.; In English; CD-ROM contains full text document in PDF format
Report No.(s): KSC-2010-004
ONLINE: http://hdl.handle.net/2060/20100036751
No Copyright; Avail.: CASI

Prior to a spacewalk during the NASA STS/129 mission in November 2009, Columbia Broadcasting System (CBS) correspondent William Harwood reported astronauts, 'were awakened again', as they had been the day previously. Fearing something not properly connected was causing a leak, the crew, both on the ground and in space, stopped and checked everything. The alarm proved false. The crew did complete its work ahead of schedule, but the incident reminds us that correctly connecting hundreds and thousands of entities, subsystems and systems, finding leaks, loosening stuck valves, and adding replacements to very large complex systems over time does not occur magically. Everywhere major projects present similar pressures. Lives are at - risk. Responsibility is heavy. Large natural and human-created disasters introduce parallel difficulties as people work across boundaries their countries, disciplines, languages, and cultures with known immediate dangers as well as the unexpected. NASA has long accepted that when humans have to go where humans cannot go that simulation is the sole solution. The Agency uses simulation to achieve consensus, reduce ambiguity and uncertainty, understand problems, make decisions, support design, do planning and troubleshooting, as well as for operations, training, testing, and evaluation. Simulation is at the heart of all such complex systems, products, projects, programs, and events.

Difficult, hazardous short and, especially, long-term activities have a persistent need for simulation from the first insight into a possibly workable idea or answer until the final report perhaps beyond our lifetime is put in the archive. With simulation we create a common mental model, try-out breakdowns of machinery or teamwork, and find opportunity for improvement. Lifecycle simulation proves to be increasingly important as risks and consequences intensify. Across the world, disasters are increasing. We anticipate more of them, as the results of global warming prove more and more ominous-glaciers melting in Bolivia, floods in Saudi Arabia, the Maldives sinking and salt rising along the Nile. Fear grows about potential asteroid crashes and nightly television images raise awareness of victims of floods, hurricanes, cyclones and typhoons, fire, tornado, tsunami, bombings, landslides, and cross-boundary criminality. The Red Cross says that disasters impact 250 million people each year. That means that 700,000 people are having a very bad day today. Modeling and simulation is and must be part of the solution. Derived from text

Complex Systems; Risk; Simulation; Space Shuttle Missions; Spacecrews

20100036780 NASA Ames Research Center, Moffett Field, CA, USA

Flight Team Development in Support of LCROSS - A Class D Mission

Tompkins, Paul D.; Hunt, Rusty; Bresina, John; Galal, Ken; Shirley, Mark; Munger, James; Sawyer, Scott; April 25, 2010; 13 pp.; In English; SpaceOps 2010 Conference: Delivering on the Dream, 25-30 Apr. 2010, Huntsville, AL, USA; Original contains color illustrations

Contract(s)/Grant(s): NNA08CG83C

Report No.(s): ARC-E-DAA-TN1248

ONLINE: http://hdl.handle.net/2060/20100036780

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The LCROSS (Lunar Crater Observation and Sensing Satellite) project presented a number of challenges to the preparation for mission operations. A class D mission under NASA s risk tolerance scale, LCROSS was governed by a $79 million cost cap and a 29 month schedule from 'authority to proceed' to flight readiness. LCROSS was NASA Ames Research Center s flagship mission in its return to spacecraft flight operations after many years of pursuing other strategic goals. As such, ARC needed to restore and update its mission support infrastructure, and in parallel, the LCROSS project had to newly define operational practices and to select and train a flight team combining experienced operators and staff from other arenas of ARC research. This paper describes the LCROSS flight team development process, which deeply involved team members in spacecraft and ground system design, implementation and test; leveraged collaborations with strategic partners; and conducted extensive testing and rehearsals that scaled in realism and complexity in coordination with ground system and spacecraft development. As a testament to the approach, LCROSS successfully met its full mission objectives, despite many in-flight challenges, with its impact on the lunar south pole on October 9, 2009.

Author

Satellite Observation; Lunar Craters; Space Missions; Spacecraft Design; Risk; Flight Operations; Systems Engineering

20100038320 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Lightning Reporting at 45th Weather Squadron: Recent Improvements

Finn, Frank C.; Roeder, William P.; Buchanan, Michael D.; McNamara, Todd M.; McAllenan, Michael; Winters, Katherine A.; Fitzpatrick, Michael E.; Huddleston, Lisa L.; April 19, 2010; 18 pp.; In English; ILDC 2010 - 21 st Intnl Lightning Detection Confereence, 19-22 Apr. 2010, Orlando, FL, USA; Original contains color illustrations

Report No.(s): KSC-2010-035

ONLINE: http://hdl.handle.net/2060/20100038320

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The 45th Weather Squadron (45 WS) provides daily lightning reports to space launch customers at CCAFS/KSC. These reports are provided to assess the need to inspect the electronics of satellite payloads, space launch vehicles, and ground support equipment for induced current damage from nearby lightning strokes. The 45 WS has made several improvements to the lightning reports during 2008-2009. The 4DLSS, implemented in April 2008, provides all lightning strokes as opposed to just one stroke per flash as done by the previous system. The 45 WS discovered that the peak current was being truncated to the nearest kilo amp in the database used to generate the daily lightning reports, which led to an up to 4% underestimate in the peak current for average lightning. This error was corrected and led to elimination of this underestimate. The 45 WS and their mission partners developed lightning location error ellipses for 99% and 95% location accuracies tailored to each individual stroke and began providing them in the spring of 2009. The new procedure provides the distance from the point of interest to the best location of the stroke (the center of the error ellipse) and the distance to the closest edge of the ellipse. This information is now included in the lightning reports, along with the peak current of the stroke. The initial method of

calculating the error ellipses could only be used during normal duty hours, i.e. not during nights, weekends, or holidays. This method was improved later to provide lightning reports in near real-time, 24/7. The calculation of the distance to the closest point on the ellipse was also significantly improved later. Other improvements were also implemented. A new method to calculate the probability of any nearby lightning stroke. being within any radius of any point of interest was developed and is being implemented. This may supersede the use of location error ellipses. The 45 WS is pursuing adding data from nine NLDN sensors into 4DLSS in real-time. This will overcome the problem of 4DLSS missing some of the strong local strokes. This will also improve the location accuracy, reduce the size and eccentricity of the location error ellipses, and reduce the probability of nearby strokes being inside the areas of interest when few of the 4DLSS sensors are used in the stroke solution. This will not reduce 4DLSS performance when most of the 4DLSS sensors are used in the stroke solution. Finally, several possible future improvements were discussed, especially for improving the peak current estimate and the error estimate for peak current, and upgrading the 4DLSS. Some possible approaches for both of these goals were discussed.
Author
Lightning; Data Bases; Ground Support Equipment; Real Time Operation; Spacecraft Launching; Damage; Payloads

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information see also *04 Aircraft Communications and Navigation*; and *32 Communications and Radar*.

20100036821 NASA Johnson Space Center, Houston, TX, USA
An Autonomous Onboard Targeting Algorithm Using Finite Thrust Maneuvers
Scarritt, Sara K.; Marchand, Belinda G.; Brown, Aaron J.; Tracy, William H.; Weeks, Michael W.; [2010]; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NNX07AR46G
Report No.(s): JSC-CN-21507
ONLINE: http://hdl.handle.net/2060/20100036821
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In earlier investigations, the adaptation and implementation of a modified two-level corrections (or targeting) process as the onboard targeting algorithm for the Trans-Earth Injection phase of Orion is presented. The objective of that targeting algorithm is to generate the times of ignition and magnitudes of the required maneuvers such that the desired state at entry interface is achieved. In an actual onboard flight software implementation, these times of ignition and maneuvers are relayed onto Flight Control for command and execution. Although this process works well when the burn durations or burn arcs are small, this might not be the case during a contingency situation when lower thrust engines are employed to perform the maneuvers. Therefore, a new model for the two-level corrections process is formulated here to accommodate finite burn arcs. This paper presents the development and formulation of the finite burn two-level corrector, used as an onboard targeting algorithm for the Trans-Earth Injection phase of Orion. A performance comparison between the impulsive and finite burn models is also presented. The present formulation ensures all entry constraints are met, without violating the available fuel budget, while allowing for low-thrust scenarios with long burn durations.
Author
Algorithms; Autonomy; Thrust; Transearth Injection; Transfer Orbits; Spacecraft Control

20100037970 NASA Ames Research Center, Moffett Field, CA, USA
Photometer Performance Assessment in Kepler Science Data Processing
Li, Jie; Allen, Christopher; Bryson, Stephen T.; Caldwell, Douglas A.; Chandrasekaran, Hema; Clarke, Bruce D.; Gunter, Jay P.; Jenkins, Jon M.; Klaus, Todd C.; Quintana, Elisa V.; Tenenbaum, Peter; Twicken, Joseph D.; Wohler, Bill; Wu, Hayley; June 18, 2010; 11 pp.; In English; 2010 SPIE Astronomical Instrumentation Conference: Observational Frontiers of Astronomy for the New Decade, 27 Jun. - 2 Jul. 2010, San Diego, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS2-02090; NNX07AD98A
Report No.(s): ARC-E-DAA-TN1817
ONLINE: http://hdl.handle.net/2060/20100037970
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This paper describes the algorithms of the Photometer Performance Assessment (PPA) software component in the science data processing pipeline of the Kepler mission. The PPA performs two tasks: One is to analyze the health and performance

of the Kepler photometer based on the long cadence science data down-linked via Ka band approximately every 30 days. The second is to determine the attitude of the Kepler spacecraft with high precision at each long cadence. The PPA component is demonstrated to work effectively with the Kepler flight data.
Author
Photometers; Kepler Mission; Extremely High Frequencies; Data Processing; Attitude (Inclination); Algorithms

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance; 39 Structural Mechanics*; and *16 Space Transportation and Safety*.

20100036763 NASA Johnson Space Center, Houston, TX, USA
Orion Landing and Recovery Systems Development - Government Contributions
Machin, Ricardo A.; October 13, 2010; 7 pp.; In English; JSC Commercial Human Spaceflight Symposium, 13-14 Oct. 2010, Houston, TX, USA; Original contains color illustrations
Report No.(s): JSC-CN-21816
ONLINE: http://hdl.handle.net/2060/20100036763
No Copyright; Avail.: CASI

This slide presentation reviews NASA's work in development of landing and recovery systems for the Orion space craft. It includes a review of the available tools and skills that assist in analyzing the aerodynamic decelerators. There is a description of the work that is being done on the Government Furnished Equipment (GFE) parachutes that will be used with the Orion Crew Exploration Vehicle (CEV)
CASI
Aerodynamic Brakes; Crew Exploration Vehicle; Parachutes; Systems Engineering; Spacecraft Design

20100036778 Boeing Co., Houston, TX, USA
Composite Overwrapped Pressure Vessels (COPV): Developing Flight Rationale for the Space Shuttle Program
Kezirian, Michael T.; November 03, 2010; 74 pp.; In English; Original contains color illustrations
Report No.(s): JSC-CN-21876
ONLINE: http://hdl.handle.net/2060/20100036778
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Introducing composite vessels into the Space Shuttle Program represented a significant technical achievement. Each Orbiter vehicle contains 24 (nominally) Kevlar tanks for storage of pressurized helium (for propulsion) and nitrogen (for life support). The use of composite cylinders saved 752 pounds per Orbiter vehicle compared with all-metal tanks. The weight savings is significant considering each Shuttle flight can deliver 54,000 pounds of payload to the International Space Station. In the wake of the Columbia accident and the ensuing Return to Flight activities, the Space Shuttle Program, in 2005, re-examined COPV hardware certification. Incorporating COPV data that had been generated over the last 30 years and recognizing differences between initial Shuttle Program requirements and current operation, a new failure mode was identified, as composite stress rupture was deemed credible. The Orbiter Project undertook a comprehensive investigation to quantify and mitigate this risk. First, the engineering team considered and later deemed as unfeasible the option to replace existing all flight tanks. Second, operational improvements to flight procedures were instituted to reduce the flight risk and the danger to personnel. Third, an Orbiter reliability model was developed to quantify flight risk. Laser profilometry inspection of several flight COPVs identified deep (up to 20 mil) depressions on the tank interior. A comprehensive analysis was performed and it confirmed that these observed depressions were far less than the criterion which was established as necessary to lead to liner buckling. Existing fleet vessels were exonerated from this failure mechanism. Because full validation of the Orbiter Reliability Model was not possible given limited hardware resources, an Accelerated Stress Rupture Test of a flown flight vessel was

performed to provide increased confidence. A Bayesian statistical approach was developed to evaluate possible test results with respect to the model credibility and thus flight rationale for continued operation of the Space Shuttle with existing flight hardware. A non-destructive evaluation (NDE) technique utilizing Raman Spectroscopy was developed to directly measure the overwrap residual stress state. Preliminary results provide optimistic results that patterns of fluctuation in fiber elastic strains over the outside vessel surface could be directly correlated with increased fiber stress ratios and thus reduced reliability.
Author
Accelerated Life Tests; Composite Wrapping; Pressure Vessels; Space Shuttles; Nondestructive Tests; Reliability Analysis

20100036781 NASA Ames Research Center, Moffett Field, CA, USA
Development of Thermal Protection Materials for Future Mars Entry, Descent and Landing Systems
Cassell, Alan M.; Beck, Robin A. S.; Arnold, James O.; Hwang, Helen; Wright, Michael J.; Szalai, Christine E.; Blosser, Max; Poteet, Carl C.; June 30, 2010; 23 pp.; In English; 10th AIAA/ASME Joint Thermophysics and Heat Transfer Conference, 28 Jun. - 1 Jul. 2010, Chicago, IL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNA04BC25C; NAS2-03144
Report No.(s): ARC-E-DAA-TN1676
ONLINE: http://hdl.handle.net/2060/20100036781
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Entry Systems will play a crucial role as NASA develops the technologies required for Human Mars Exploration. The Exploration Technology Development Program Office established the Entry, Descent and Landing (EDL) Technology Development Project to develop Thermal Protection System (TPS) materials for insertion into future Mars Entry Systems. An assessment of current entry system technologies identified significant opportunity to improve the current state of the art in thermal protection materials in order to enable landing of heavy mass (40 mT) payloads. To accomplish this goal, the EDL Project has outlined a framework to define, develop and model the thermal protection system material concepts required to allow for the human exploration of Mars via aerocapture followed by entry. Two primary classes of ablative materials are being developed: rigid and flexible. The rigid ablatives will be applied to the acreage of a 10x30 m rigid mid L/D Aeroshell to endure the dual pulse heating (peak approx.500 W/sq cm). Likewise, flexible ablative materials are being developed for 20-30 m diameter deployable aerodynamic decelerator entry systems that could endure dual pulse heating (peak aprrox.120 W/sq cm). A technology Roadmap is presented that will be used for facilitating the maturation of both the rigid and flexible ablative materials through application of decision metrics (requirements, key performance parameters, TRL definitions, and evaluation criteria) used to assess and advance the various candidate TPS material technologies.
Author
Landing Aids; Descent; Mars Landing; Mars Exploration; Thermal Protection; Performance Tests; Aerocapture

20100036836 NASA Langley Research Center, Hampton, VA, USA
Spacecraft Attitude Tracking and Maneuver Using Combined Magnetic Actuators
Zhou, Zhiqiang; August 02, 2010; 17 pp.; In English; AIAA Guidance, Navigation and Control Conference, 2-5 Aug. 2010, Toronto, Canada; Original contains color illustrations
Contract(s)/Grant(s): WBS 304029.01.04.02.02
Report No.(s): AIAA Paper 2010-7899; NF1676L-10005
ONLINE: http://hdl.handle.net/2060/20100036836
No Copyright; Avail.: CASI

The accuracy of spacecraft attitude control using magnetic actuators only is low and on the order of 0.4-5 degrees. The key reason is that the magnetic torque is two-dimensional and it is only in the plane perpendicular to the magnetic field vector. In this paper novel attitude control algorithms using the combination of magnetic actuators with Reaction Wheel Assembles (RWAs) or other types of actuators, such as thrusters, are presented. The combination of magnetic actuators with one or two RWAs aligned with different body axis expands the two-dimensional control torque to three-dimensional. The algorithms can guarantee the spacecraft attitude and rates to track the commanded attitude precisely. A design example is presented for Nadir pointing, pitch and yaw maneuvers. The results show that precise attitude tracking can be reached and the attitude control

accuracy is comparable with RWAs based attitude control. The algorithms are also useful for the RWAs based attitude control. When there are only one or two workable RWAs due to RWA failures, the attitude control system can switch to the control algorithms for the combined magnetic actuators with the RWAs without going to the safe mode and the control accuracy can be maintained.
Author
Actuators; Attitude Control; Magnetic Fields; Spacecraft Control; Torque

20100037222 NASA Johnson Space Center, Houston, TX, USA
Recommendations for Exploration Spacecraft Internal Atmospheres: The Final Report of the NASA Exploration Atmospheres Working Group
October 2010; 178 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TP-2010-216134; S-1080
ONLINE: http://hdl.handle.net/2060/20100037222
No Copyright; Avail.: CASI

The authors of this document recommend that, to enable missions to the moon and Mars, NASA's Constellation vehicles, habitats, and spacesuits employ an integrated set of internal atmospheres rather than a single design for all elements. These atmospheres must mitigate the risks of fire, decompression sickness, and hypoxia while enabling crew excursions on planetary surfaces. It should be noted that the recommendations provided in this document are not requirements; instead, they reflect technical considerations only. To support the recommendations made herein, Constellation should institute a modified standard NASA flammability test as soon as possible to generate ignition threshold data for key spacecraft materials. This modified test will allow the agency to identify materials at risk from increases in oxygen concentration, minimize potential impacts, and allow for development of sound requirements for landers and habitats. The Human Research, Technology Development, and Constellation Programs should also initiate activities to enable atmosphere designs for, respectively, human research, technology development, and program-specific studies to validate these recommendations for the Constellation habitable elements.
Author
Cabin Atmospheres; Constellation Program; Life Support Systems; Planetary Surfaces

20100038325 NASA Johnson Space Center, Houston, TX, USA
Extraction of Modal Parameters from Spacecraft Flight Data
James, George H.; Cao, Timothy T.; Fogt, Vincent A.; Wilson, Robert L.; Bartkowicz, Theodore J.; January 2010; 13 pp.; In English; International Modal Analysis Conference, 31 Jan. - 3 Feb. 2011, Jacksonville, FL, USA; Original contains color illustrations
Report No.(s): JSC-CN-22001
ONLINE: http://hdl.handle.net/2060/20100038325
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The modeled response of spacecraft systems must be validated using flight data as ground tests cannot adequately represent the flight. Tools from the field of operational modal analysis would typically be brought to bear on such structures. However, spacecraft systems have several complicated issues: 1. High amplitudes of loads; 2. Compressive loads on the vehicle in flight; 3. Lack of generous time-synchronized flight data; 4. Changing properties during the flight; and 5. Major vehicle changes due to staging. A particularly vexing parameter to extract is modal damping. Damping estimation has become a more critical issue as new mass-driven vehicle designs seek to use the highest damping value possible. The paper will focus on recent efforts to utilize spacecraft flight data to extract system parameters, with a special interest on modal damping. This work utilizes the analysis of correlation functions derived from a sliding window technique applied to the time record. Four different case studies are reported in the sequence that drove the authors understanding. The insights derived from these four exercises are preliminary conclusions for the general state-of-the-art, but may be of specific utility to similar problems approached with similar tools.
Author
Spacecraft Launching; Spacecraft Configurations; Tethered Satellites; Flight Tests; Aerospace Systems

23
CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

20100036782 NASA Ames Research Center, Moffett Field, CA, USA

Oxidation Characterization of Hafnium-Based Ceramics Fabricated by Hot Pressing and Electric Field-Assisted Sintering

Gasch, Matt; Johnson, Sylvia; Marschall, Jochen; September 20, 2010; 5 pp.; In English; 7th International Conference on High Temperature Ceramic matrix Composites, 20-22 Sep. 2010, Bayreuth, Bavaria, Germany, Germany; Original contains black and white illustrations

Contract(s)/Grant(s): FA9550-050-C-0020; FA9550-08-C-0049; WBS 599489.02.07.01.02.21.22

Report No.(s): ARC-E-DAA-TN1583

ONLINE: http://hdl.handle.net/2060/20100036782

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Ceramic borides, such as hafnium diboride (HfB2) and zirconium diboride (ZrB2), are members of a family of materials with extremely high melting temperatures referred to as Ultra High Temperature Ceramics (UHTCs). UHTCs constitute a class of promising materials for use in high temperature applications, such as sharp leading edges on future-generation hypersonic flight vehicles, because of their high melting points. The controlled development of microstructure has become important to the processing of UHTCs, with the prospect of improving their mechanical and thermal properties. The improved oxidation resistance of HfB2 has also become important if this material is to be successfully used at temperatures above 2000 C. Furthermore, the use of UHTCs on the leading edges of vehicles traveling at hypersonic speeds will mean exposure to a mixed oxidation environment comprised of both molecular and atomic oxygen. The current study has investigated the high-temperature oxidation behavior of HfB2-based materials in a pure O2 environment, as well as in environments containing different levels of dissociated oxygen (O/O2). Materials were processed by two techniques: conventional hot pressing (HP) and electric field-assisted sintering (FAS). Their oxidation behavior was evaluated in both a tube furnace at 1250 C for 3 hours and in a simulated re-entry environment in the Advanced Heating Facility (AHF) arcjet at NASA Ames Research Center, during a 10-minute exposure to a cold wall heat flux of 250W/sq cm and stagnation pressure of 0.1-0.2 atm. The microstructure of the different materials was characterized before and after oxidation using scanning electron microscopy (SEM).

Author

Ceramics; Hot Pressing; Electric Fields; Sintering; Hafnium; Oxidation Resistance; Thermodynamic Properties; Stagnation Pressure; Oxygen Atoms

20100037880

Design and Development of High Performance Polymer Fuel Cell Membranes. Final Technical Report

Suriano, J.; April 2010; 14 pp.; In English

Contract(s)/Grant(s): DE-FG36-06GO16034

Report No.(s): DE2010-977060

No Copyright; Avail.: National Technical Information Service (NTIS)

The objectives of the program were to design and develop novel polymer electrolyte membrane materials for fuel cell operation at high temperature (up to 120C) and low relative humidity (25-50%). The initial proposed approach was designed to improve on independent GE research on random and block copolymer PEM materials, specifically to investigate sulfonated graft copolymer architectures and the use of hydrophilic additives based on sulfonamide and imide structures. It was envisioned that this would promote phase separation and ionic aggregation leading to more efficient H+ conduction. In addition concentrating the acid groups on pendent chains while keeping a neutral polymer backbone to enable better mechanical and chemical stability under fuel cell operating conditions.

NTIS

Fuel Cells; High Polymers; Membranes; Solid Electrolytes

24
COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20100036748 NASA Langley Research Center, Hampton, VA, USA

Ultrasonic Monitoring of Ply Crack and Delamination Formation in Composite Tube Under Torsion Load

Johnston, P. H.; Wright, C. W.; Zalameda, J. N.; Seebo, J. P.; October 11, 2010; 4 pp.; In English; 2010 IEEE International Ultrasonics Symposium, 11-14 Oct. 2010, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 698259.02.07.07.02

Report No.(s): NF1676L-10671

ONLINE: http://hdl.handle.net/2060/20100036748

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As a simple model of a rotor spar, a circular graphite-epoxy composite laminate cylinder was subjected to cyclic torsional load. The test section of the cylindrical specimen varied from four to six plies of plus or minus 45 degree fibers, due to intentional ply overlaps and gaps. A layer of 13-micrometer Teflon film was inserted between plies at three locations to serve as delamination initiators. A commercial X-Y scanner was mounted to the load frame to enable ultrasonic inspection without removing the specimen. A focused immersion probe was mounted in a captive water column with a rugged Nitrile membrane tip, which was coupled to the cylinder using a mist of soapy water. The transducer was aligned normal to the cylinder surface using the X-axis. Scanning was performed along the length of the specimen with the Y-axis and the specimen was incrementally rotated by the torsion head of the load frame. After 350k cycles of torsion, several linear 45 degree diagonal indications appeared as 5-40% attenuation of the back wall echo, with no apparent echoes from the interior of the composite, suggesting through-ply cracks in the innermost ply. Crack indications grew and new cracks appeared as torsion cycling continued. Internal reflections from delaminations associated with the growing ply cracks appeared after 500k cycles. Three areas of extensive multi-layer delaminations appeared after 1150k cycles. Failure of the specimen occurred at 1600k cycles. The observed progressive damage was not associated with the Teflon inclusions. Concurrent thermographic measurements provided lower resolution confirmation of the damage observed.

Author

Composite Structures; Cracks; Delaminating; Loads (Forces); Torsion; Ultrasonics; Ply Orientation

20100036837 NASA Langley Research Center, Hampton, VA, USA

Modeling Geometry and Progressive Failure of Material Interfaces in Plain Weave Composites

Hsu, Su-Yuen; Cheng, Ron-Bin; October 26, 2010; 19 pp.; In English; 10th International Conference on Textile Composites, 26-28 Oct. 2010, Lille, France; Original contains color illustrations

Contract(s)/Grant(s): WBS 599489.02.07.07.02.11.01

Report No.(s): NF1676L-10275

ONLINE: http://hdl.handle.net/2060/20100036837

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A procedure combining a geometrically nonlinear, explicit-dynamics contact analysis, computer aided design techniques, and elasticity-based mesh adjustment is proposed to efficiently generate realistic finite element models for meso-mechanical analysis of progressive failure in textile composites. In the procedure, the geometry of fiber tows is obtained by imposing a fictitious expansion on the tows. Meshes resulting from the procedure are conformal with the computed tow-tow and tow-matrix interfaces but are incongruent at the interfaces. The mesh interfaces are treated as cohesive contact surfaces not only to resolve the incongruence but also to simulate progressive failure. The method is employed to simulate debonding at the material interfaces in a ceramic-matrix plain weave composite with matrix porosity and in a polymeric matrix plain weave composite without matrix porosity, both subject to uniaxial cyclic loading. The numerical results indicate progression of the interfacial damage during every loading and reverse loading event in a constant strain amplitude cyclic process. However, the composites show different patterns of damage advancement.

Author

Failure Analysis; Two Dimensional Models; Nonlinearity; Geometry; Weaving

20100037764 NASA Langley Research Center, Hampton, VA, USA

Comparison of Damage Models for Predicting the Non-Linear Response of Laminates Under Matrix Dominated Loading Conditions

Schueckner, Clara; Davila, Carlos G.; Rose, Cheryl A.; October 2010; 43 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698259.02.07.07.03.03

Report No.(s): NASA/TP-2010-216856; L-19916; NF1676L-11291

ONLINE: http://hdl.handle.net/2060/20100037764

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Five models for matrix damage in fiber reinforced laminates are evaluated for matrix-dominated loading conditions under plane stress and are compared both qualitatively and quantitatively. The emphasis of this study is on a comparison of the response of embedded plies subjected to a homogeneous stress state. Three of the models are specifically designed for modeling the non-linear response due to distributed matrix cracking under homogeneous loading, and also account for non-linear (shear) behavior prior to the onset of cracking. The remaining two models are localized damage models intended for predicting local failure at stress concentrations. The modeling approaches of distributed vs. localized cracking as well as the different formulations of damage initiation and damage progression are compared and discussed.

Author

Fiber Composites; Plane Stress; Embedding; Damage; Crack Initiation; Laminates

20100037801

Elevated Temperature Aging of Glass Fiber Reinforced Vinyl Ester and Isopthalic Polyester Composites in Water, Salt Water and Concrete Pore Solution

Chin, J. W.; Hughes, W. L.; Signor, A.; January 2010; 12 pp.; In English

Report No.(s): PB2010-113881

No Copyright; Avail.: National Technical Information Service (NTIS)

In recent years, the use of fiber-reinforced vinyl ester and isophthalic polyester (isopolyester) composites in civil infrastructure has grealty increased, due to an optimum combination of desirable properties, processability, and ease of installation associated with these materials, One obstacle hidering greater acceptance of polymer composites in civil infrastructure applications is the susceptibility of the polymer matrices to degradation initiated by moisture, temperture and corrosive chemical environments. The objective of this study was to characterize chemical and physical changes in glass-fiber reinforced vinyl ester and isopolyester mateials following exposure to water,salt water and an artificial concrete pore solution. Exposures was carried out at room temperature, 40 C, 60 C, 80 C: glass transition temperature and interlaminar shear strength were monitored as a function of aging time and temperature. In general, more rapid degradation in properties was observed in conrete pore solution than either water or salt solution for both polymers. A modified arrhenius analysis was carried out on the data to determine whether any observed accerleration in degradation was valid over such a wide temperature range. Arrhenius polots for isopolyester generated by poltting In (time to reach 70 percent of original strength) vs (temperature) could be fitted with straight line for water and salt solumtion, but not for concrete pore solution. Arrhenius analyses carried out on the vinyl ester data resulted in approximately straight line fits for all three environments.

NTIS

Aging (Metallurgy); Concretes; Esters; Fiber Composites; Glass Fibers; High Temperature; Polyesters; Water

20100037837

Quantifying the Micromechanical Effects of Variable Cement in Granular Porous Media

Goodwin, L. B.; Cook, J. E.; Boutt, D. F.; Plourde, K.; February 18, 2010; 25 pp.; In English

Contract(s)/Grant(s): FG02-05ER15738

Report No.(s): DE2010-978017

No Copyright; Avail.: National Technical Information Service (NTIS)

The mechanical and hydrologic behavior of clastic rocks and sediments is fundamentally controlled by variables such as grain size and shape, sorting, grain and cement mineralogy, porosity, and % cement - parameters that are not used directly in field-scale models of coupled flow and deformation. To improve our understanding of the relationship between these micromechanical properties and bulk behavior we focused on (1) relating detailed, quantitative characterization of the grain-pore systems to both hydrologic and mechanical properties of a suite of variably quartz-cemented quartz arenite samples and (2) the use of a combination of discrete element method (DEM) and poroelastic models parameterized by data from the

natural samples to isolate and compare the influence of changes in the mechanical and hydrologic properties of granular porous media due to changes in degree of cementation.
NTIS
Cements; Micromechanics; Porosity

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

20100037878
Surface Absorption Polarization Sensors (SAPS). Final Technical Report
Cline, J. I.; Bell, T. W.; Cremo, C. R.; April 22, 2010; 16 pp.; In English
Contract(s)/Grant(s): DE-FC52-05NA26973
Report No.(s): DE2010-977056; DOE/NA/26973-1
No Copyright; Avail.: National Technical Information Service (NTIS)

A novel hypothesized detection scheme for the detection of chemical agents was proposed: SAPS Surface-Adsorbed Polarization Sensors. In this technique a thin layer of molecular rotors is adsorbed to a surface. The rotors can be energized by light absorption, but are otherwise locked in position or alternatively rotate slowly. Using polarized light, the adsorbed rotors are turned as an ensemble. Chemical agent (analyte) binding that alters the rotary efficiency would be detected by sensitive polarized absorption techniques. The mechanism of the SAPS detection can be mechanical, chemical, or photochemical: only a change in rotary efficiency is required. To achieve the goal of SAPS detection, new spectroscopic technique, polarized Normal Incidence Cavity Ringdown Spectroscopy (polarized NICRDS), was developed. The technique employs very sensitive and general Cavity Ringdown absorption spectroscopy along with the ability to perform polarized absorption measurements. Polarized absorption offers the ability to measure the angular position of molecular chromophores. In the new experiments a thin layer of SAPS sensors (roughly corresponding to a monolayer coverage on a surface) immobilized in PMMA.
NTIS
Absorption; Polarization; Sensors

26
METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20100036814 NASA Marshall Space Flight Center, Huntsville, AL, USA
Linear Stability of Binary Alloy Solidification for Unsteady Growth Rates
Mazuruk, K.; Volz, M. P.; August 08, 2010; 1 pp.; In English; 16th International Conference on Crystal Growth, 8-13 Aug. 2010, Beijing, China
Report No.(s): M10-0371
ONLINE: http://hdl.handle.net/2060/20100036814
Copyright; Distribution as joint owner in the copyright; Avail.: CASI

An extension of the Mullins and Sekerka (MS) linear stability analysis to the unsteady growth rate case is considered for dilute binary alloys. In particular, the stability of the planar interface during the initial solidification transient is studied in detail numerically. The rapid solidification case, when the system is traversing through the unstable region defined by the MS criterion, has also been treated. It has been observed that the onset of instability is quite accurately defined by the 'quasi-stationary MS criterion', when the growth rate and other process parameters are taken as constants at a particular time of the growth process. A singular behavior of the governing equations for the perturbed quantities at the constitutional supercooling demarcation line has been observed. However, when the solidification process, during its transient, crosses this demarcation line, a planar interface is stable according to the linear analysis performed.
Author
Binary Alloys; Solidification; Stability; Linearity; Alloying; Rapid Quenching (Metallurgy); Stability Tests

27
NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20100037840

Novel Nanocrystalline Intermetallic Coatings for Metal Alloys in Coal-fired Environments. Final Report. (September 2005-September 2009)

Fang, Z. Z.; Sohn, H. Y.; January 08, 2010; 38 pp.; In English

Contract(s)/Grant(s): DE-FG26-05NT42529

Report No.(s): DE2010-978339

No Copyright; Avail.: National Technical Information Service (NTIS)

Intermetallic coatings (iron aluminide and nickel aluminide) were prepared by a novel reaction process. In the process, the aluminide coating is formed by an in-situ reaction between the aluminum powder fed through a plasma transferred arc (PTA) torch and the metal substrate (steel or Ni-base alloy). Subjected to the high temperature within an argon plasma zone, aluminum powder and the surface of the substrate melt and react to form the aluminide coatings. The prepared coatings were found to be aluminide phases that are porosity-free and metallurgically bonded to the substrate. The coatings also exhibit excellent high-temperature corrosion resistance under the conditions which simulate the steam-side and fire-side environments in coal-fired boilers. It is expected that the principle demonstrated in this process can be applied to the preparation of other intermetallic and alloy coatings.

NTIS

Alloys; Aluminides; Coal; Combustion; Composite Materials; Intermetallics; Thermal Control Coatings

20100037873

Hydrogen Separation Membranes: Annual Report for FY 2009

Balachandran, U.; Dorris, S. E.; Lu, Y.; Emerson, J. E.; Park, C. Y.; January 30, 2010; 41 pp.; In English

Contract(s)/Grant(s): DE-AC02-06CH11357

Report No.(s): DE2010-977047; ANL-10/09

No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of this work is to develop dense ceramic membranes for separating hydrogen from other gaseous components in a nongalvanic mode, i.e., without using an external power supply or electrical circuitry.

NTIS

Ceramics; Hydrogen; Membranes

20100037875

Hydrogen Production by Water Dissociation Using Ceramic Membranes: Annual Report for FY 2009

Balachandran, U.; Dorris, S. E.; Lu, Y.; Emerson, J. E.; Park, C. Y.; February 23, 2010; 38 pp.; In English

Contract(s)/Grant(s): DE-AC02-06CH11357

Report No.(s): DE2010-977048; ANL-10/13

No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of this project is to develop dense ceramic membranes that can produce hydrogen via coal/coal gas-assisted water dissociation without using an external power supply or circuitry.

NTIS

Ceramics; Dissociation; Hydrogen Production; Membranes; Water Splitting

20100037885 Sandia National Labs., Albuquerque, NM USA

Antibacterial Polymer Coatings

Hibbs, M. R.; Barnhart, M.; Allen, A. N.; Wilson, M. C.; Tucker, M. D.; September 2009; 42 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL85000

Report No.(s): DE2010-977233; SAND2009-6171

No Copyright; Avail.: National Technical Information Service (NTIS)

A series of poly(sulfone)s with quaternary ammonium groups and another series with aldehyde groups are synthesized and tested for biocidal activity against vegetative bacteria and spores, respectively. The polymers are sprayed onto substrates as

coatings which are then exposed to aqueous suspensions of organisms. The coatings are inherently biocidal and do not release any agents into the environment. The coatings adhere well to both glass and CARC-coated coupons and they exhibit significant biotoxicity. The most effective quaternary ammonium polymers kills 99.9% of both gram negative and gram positive bacteria and the best aldehyde coating kills 81% of the spores on its surface.
NTIS
Antiinfectives and Antibacterials; Ammonium Compounds; Synthesis (Chemistry); Sulfones; Polymers

28
PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

20100037187 NATO Research and Technology Organization, Neuilly-sur-Seine, France
Environmental Impact of Munition and Propellant Disposal
February 2010; 86 pp.; In English; Original contains color illustrations
Report No.(s): RTO-TR-AVT-115; AC/323(AVT-115)TP/274
Copyright; Avail.: CASI

The environmentally acceptable disposal of surplus munitions has become a major problem for NATO and others. The NATO Research Technology Organization carried out a study of the problems and tried to identify both gaps and possible research directions to fill these. It covered not only disposal but also land contamination and included a Workshop in Sofia in September 2007. The conclusions and recommendations will be outlined.
Author
Ammunition; Disposal; Contaminants; Propellants

31
ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20100036842 NASA Kennedy Space Center, Cocoa Beach, FL, USA
2010 ESMD Faculty Fellowship Project
Carmen, Christina L.; Morris, Tommy; Schmidt, Peter; van Susante, Paul; Zalewski, Janusz; Murphy, Gloria; September 10, 2010; 67 pp.; In English; National Space Grant Regional Meeting, 10-11 Sept. 2010, Newport, RI, USA; Original contains color illustrations
Contract(s)/Grant(s): NNK10OD06P
Report No.(s): KSC-2010-228
ONLINE: http://hdl.handle.net/2060/20100036842
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This slide presentation reviews is composed of 6 individual sections. The first is a introductory section that explains the Exploration Systems Mission Directorate (ESMD) Faculty Fellowship Project, the purpose of which is to prepare selected university faculty to work with senior design students to complete projects that have potential to contribute to NASA objectives. The following university presentations represent the chosen projects: (1) the use of Exploration Toolset for the Optimization of Launch and Space Systems (X-TOOLSS) to optimize the Lunar Wormbot design; (2) development of Hardware Definition Language (HDL) realization of ITU G.729 for FGPA; (3) cryogenic fluid and electrical quick connect system and a lunar regolith design; (4) Lunar Landing Pad development; and (5) Prognostics for complex systems.
CASI
Aerospace Systems; Students; Universities; Instructors; Education

32
COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and *17 Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see *03 Air Transportation and Safety*; and *16 Space Transportation and Safety*.

20100037769 NASA Langley Research Center, Hampton, VA, USA

A New Approach for Checking and Complementing CALIPSO Lidar Calibration

Josset, Damien B.; Vaughan, Mark A.; Hu, Yongxiang; Avery, Melody A.; Powell, Kathleen A.; Hunt, William H.; Winker, David M.; Pelon, Jacques; Trepte, Charles R.; Lucker, Patricia L.; Zhai, Pengwang; Rodier, Sharon D.; Tanelli, Simone; Dobrowalski, G.; October 25, 2010; 1 pp.; In English; International Symposium on the A-Train Satellite Constellation 2010, 25-28 Oct. 2010, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 653967.04.12.01

Report No.(s): NF1676L-11600

ONLINE: http://hdl.handle.net/2060/20100037769

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We have been studying the backscatter ratio of the two CALIPSO wavelengths for 3 different targets. We are showing the ratio of integrate attenuated backscatter coefficient for cirrus clouds, ocean surface and liquid. Water clouds for one month of nightime data (left:July,right:December), Only opaque cirrus classified as randomly oriented ice[1] are used. For ocean and water clouds, only the clearest shots, determined by a threshold on integrated attenuated backscatter are used. Two things can be immediately observed: 1. A similar trend (black dotted line) is visible using all targets, the color ratio shows a tendency to be higher north and lower south for those two months. 2. The water clouds average value is around 15% lower than ocean surface and cirrus clouds. This is due to the different multiple scattering at 532 nm and 1064 nm [2] which strongly impact the water cloud retrieval. Conclusion: Different targets can be used to improve CALIPSO 1064 nm calibration accuracy. All of them show the signature of an instrumental calibration shift. Multiple scattering introduce a bias in liquid water cloud signal but it still compares very well with all other methods and should not be overlooked. The effect of multiple scattering in liquid and ice clouds will be the subject of future research. If there really is a sampling issue. Combining all methods to increase the sampling, mapping the calibration coefficient or trying to reach an orbit per orbit calibration seems an appropriate way. Author

Calibrating; Optical Radar; Scattering Coefficients; Ice Clouds; Ocean Surface; Cirrus Clouds

20100037805

Coast Guard's Boat Crew Communications System is Unreliable

May 2010; 13 pp.; In English

Report No.(s): PB2010-114581; OIG-10-85

No Copyright; Avail.: National Technical Information Service (NTIS)

This report addresses the effectiveness of the Coast Guard's boat crew communications system to support maritime operations. We conducted this work as part of our audit to determine whether the current Maritime Safety and Security Team (MSST) program and structure is the best approach for the Coast Guard to accomplish its maritime law enforcement and homeland security missions. We incorporated formal comments from the Chief, Office of Budget and Programs in the report. NTIS

Boats; Coasts; Safety; Security; Telecommunication

20100037887 Texas A&M Univ., College Station, TX USA

Bluetooth(Trade Name)-Based Travel Time/Speed Measuring Systems Development

Puckett, D. D.; Vickich, M. J.; June 2010; 56 pp.; In English

Contract(s)/Grant(s): DTRT06-G-0044

Report No.(s): PB2010-110835; UTCM-09-00-17

No Copyright; Avail.: National Technical Information Service (NTIS)

Agencies in the Houston region have traditionally used toll tag readers to provide travel times on freeways and High Occupancy Vehicle (HOV) lanes, but these systems require large amounts of costly and physically invasive infrastructure. Bluetooth is a widely used technology embedded in cellular telephones and in-vehicle applications for exchanging data over

short distances. The initial demonstrations of wireless address matching were primarily designed to prove the ability for Bluetooth technology to produce matches between two points on a roadway outfitted with the proper Bluetooth reader equipment, with a resulting travel time and speed calculated. Costs for Bluetooth travel time measurement systems are one to two orders of magnitude below costs for traditional toll tag reader equipment, depending on the application. This cost advantage could significantly lower the threshold for hundreds of agencies and private entities to enter the travel time measurement market, but there is little guidance on the application. Development and testing of various prototype software and hardware platforms were conducted to use the anonymous Media Access Control (MAC) address from each Bluetooth device to measure and report real-time traffic conditions.
NTIS
Systems Engineering; Telephones; Wireless Communication; Air Traffic Control

33
ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20100037250 NASA Johnson Space Center, Houston, TX, USA
Safety Limitations Associated with Commercial 18650 Lithium-ion Cells
Jeevarajan, Judith A.; November 03, 2010; 40 pp.; In English; Lithium Mobile Power and Battery Safety 2010, 3-5 Nov. 2010, Boston, MA, USA
Contract(s)/Grant(s): WBS 377816.06.02.05.03.20.01
Report No.(s): JSC-CN-21966
ONLINE: http://hdl.handle.net/2060/20100037250
No Copyright; Avail.: CASI

In the past decade, NASA-JSC battery group has carried out several tests on the safety of li-ion cells, modules and battery packs. The hazards associated with using commercial li-ion cells in high voltage and high capacity batteries have been determined to be different from those associated with the use of the same cells in low voltage, low capacity packs (less than 15 V and 60 Wh). Tests carried out included overcharge, overdischarge, external and internal short circuits with destructive physical analysis included in most cases. Chemical analysis, X-rays and in some cases CT scans were used for post-test analysis.
Derived from text
Lithium; Metal Ions; Chemical Analysis; Electric Batteries; High Voltages; Safety

20100037845
Electronic Waste: Considerations for Promoting Environmentally Sound Reuse and Recycling
July 2010; 70 pp.; In English
Report No.(s): PB2010-113233; GAO-10-626
No Copyright; Avail.: National Technical Information Service (NTIS)

Low recycling rates for used televisions, computers, and other electronics result in the loss of valuable resources, and electronic waste exports risk harming human health and the environment in countries that lack safe recycling and disposal capacity. The Environmental Protection Agency (EPA) regulates the management of used electronics that qualify as hazardous waste and promotes voluntary efforts among electronics manufacturers, recyclers, and other stakeholders. However, in the absence of a comprehensive national approach, a growing number of states have enacted electronics recycling laws, raising concerns about a patchwork of state requirements. In this context, GAO examined (1) EPA's efforts to facilitate environmentally sound used electronics management, (2) the views of various stakeholders on the state-by-state approach, and (3) considerations to further promote environmentally sound management.
NTIS
Electronic Equipment; Recycling

20100037964 NASA Ames Research Center, Moffett Field, CA, USA

Towards Accelerated Aging Methodologies and Health Management of Power MOSFETs (Technical Brief)

Celaya, Jose R.; Patil, Nishad; Saha, Sankalita; Wysocki, Phil; Goebel, Kai; September 27, 2009; 8 pp.; In English; Annual Conference of the Prognostics and Health Management Society 2009, 27 Sep. - 1 Oct. 2009, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 645846.02.07.01.01

Report No.(s): ARC-E-DAA-TN724

ONLINE: http://hdl.handle.net/2060/20100037964

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Understanding aging mechanisms of electronic components is of extreme importance in the aerospace domain where they are part of numerous critical subsystems including avionics. In particular, power MOSFETs are of special interest as they are involved in high voltage switching circuits such as drivers for electrical motors. With increased use of electronics in aircraft control, it becomes more important to understand the degradation of these components in aircraft specific environments. In this paper, we present an accelerated aging methodology for power MOSFETs that subject the devices to indirect thermal overstress during high voltage switching. During this accelerated aging process, two major modes of failure were observed - latch-up and die attach degradation. In this paper we present the details of our aging methodology along with details of experiments and analysis of the results.

Author

Aging (Materials); Avionics; Field Effect Transistors; Switching Circuits; Metal Oxide Semiconductors; Accelerated Life Tests; Degradation

34
FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20100036841 NASA Marshall Space Flight Center, Huntsville, AL, USA

Transient Three-Dimensional Side Load Analysis of Out-of-Round Film Cooled Nozzles

Wang, Ten-See; Lin, Jeff; Ruf, Joe; Guidos, Mike; July 25, 2010; 17 pp.; In English; 46th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 25-28 Jul. 2010, Nashville, TN, USA; Original contains black and white illustrations

Report No.(s): M10-0136

ONLINE: http://hdl.handle.net/2060/20100036841

No Copyright; Avail.: CASI

The objective of this study is to investigate the effect of nozzle out-of-roundness on the transient startup side loads. The out-of-roundness could be the result of asymmetric loads induced by hardware attached to the nozzle, asymmetric internal stresses induced by previous tests and/or deformation, such as creep, from previous tests. The rocket engine studied encompasses a regeneratively cooled thrust chamber and a film cooled nozzle extension with film coolant distributed from a turbine exhaust manifold. The computational methodology is based on an unstructured-grid, pressure-based computational fluid dynamics formulation, and a transient inlet history based on an engine system simulation. Transient startup computations were performed with the out-of-roundness achieved by four degrees of ovalization of the nozzle: one perfectly round, one slightly out-of-round, one more out-of-round, and one significantly out-of-round. The computed side load physics caused by the nozzle out-of-roundness and its effect on nozzle side load are reported and discussed.

Author

Asymmetry; Nozzle Design; Transient Loads; Computational Fluid Dynamics; J-2 Engine; Loads (Forces); Three Dimensional Models

20100037194 NASA Dryden Flight Research Center, Edwards, CA, USA
Analysis of the Effects of Streamwise Lift Distribution on Sonic Boom Signature
Yoo, Seung Yeun (Paul); July 2010; 20 pp.; In English; 28th AIAA Applied Aerodynamics Conference, 28 Jun. - 1 Jul. 2010, Chicago, IL, USA; Original contains color illustrations
Report No.(s): DFRC-E-DAA-TN1780
ONLINE: http://hdl.handle.net/2060/20100037194
No Copyright; Avail.: CASI

Conference presentation sharing selected aspects of the analysis of the effects of streamwise lift distribution on sonic boom signature.

Author

Lift; Sonic Booms; Computational Fluid Dynamics; Body-Wing Configurations; Computational Grids

20100037219 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thermal Analysis of the Advanced Technology Large Aperture Space Telescope (ATLAST) 8 Meter Primary Mirror
Hornsby, Linda; Stahl, H. Philip; Hopkins, Randall C.; June 27, 2010; 11 pp.; In English
Contract(s)/Grant(s): NNM05AB50C
Report No.(s): M10-0449; M10-0721; M10-0717
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The Advanced Technology Large Aperture Space Telescope (ATLAST) preliminary design concept consists of an 8 meter diameter monolithic primary mirror enclosed in an insulated, optical tube with stray light baffles and a sunshade. ATLAST will be placed in orbit about the Sun-Earth L2 and will experience constant exposure to the sun. The insulation on the optical tube and sunshade serve to cold bias the telescope which helps to minimize thermal gradients. The primary mirror will be maintained at 280K with an active thermal control system. The geometric model of the primary mirror, optical tube, sun baffles, and sunshade was developed using Thermal Desktop(R) SINDA/FLUINT(R) was used for the thermal analysis and the radiation environment was analyzed using RADCAD(R). A XX node model was executed in order to characterize the static performance and thermal stability of the mirror during maneuvers. This is important because long exposure observations, such as extra-solar terrestrial planet finding and characterization, require a very stable observatory wave front. Steady state thermal analyses served to predict mirror temperatures for several different sun angles. Transient analyses were performed in order to predict thermal time constant of the primary mirror for a 20 degree slew or 30 degree roll maneuver. This paper describes the thermal model and provides details of the geometry, thermo-optical properties, and the environment which influences the thermal performance. All assumptions that were used in the analysis are also documented. Parametric analyses are summarized for design parameters including primary mirror coatings and sunshade configuration. Estimates of mirror heater power requirements are reported. The thermal model demonstrates results for the primary mirror heated from the back side and edges using a heater system with multiple independently controlled zones.

Author

Characterization; Design Analysis; Mirrors; Temperature Control; Thermal Analysis; Astronomical Satellites; Spaceborne Telescopes; Mathematical Models; Observatories

20100037226 NASA Johnson Space Center, Houston, TX, USA
Broken Ergodicity in Ideal, Homogeneous, Incompressible Turbulence
Morin, Lee; Shebalin, John; Fu, Terry; Nguyen, Phu; Shum, Victor; December 13, 2010; 1 pp.; In English; 2010 AGU Fall Meeting, 13-17 Dec. 2010, San Francisco, CA, USA
Report No.(s): JSC-CN-21631
ONLINE: http://hdl.handle.net/2060/20100037226
Copyright; Distribution as joint owner in the copyright; Avail.: CASI; Abstract Only

We discuss the statistical mechanics of numerical models of ideal homogeneous, incompressible turbulence and their relevance for dissipative fluids and magnetofluids. These numerical models are based on Fourier series and the relevant statistical theory predicts that Fourier coefficients of fluid velocity and magnetic fields (if present) are zero-mean random variables. However, numerical simulations clearly show that certain coefficients have a non-zero mean value that can be very large compared to the associated standard deviation. We explain this phenomena in terms of broken ergodicity', which is defined to occur when dynamical behavior does not match ensemble predictions on very long time-scales. We review the theoretical basis of broken ergodicity, apply it to 2-D and 3-D fluid and magnetohydrodynamic simulations of homogeneous

turbulence, and show new results from simulations using GPU (graphical processing unit) computers.
Author
Magnetohydrodynamic Turbulence; Mathematical Models; Simulation; Statistical Analysis; Ergodic Process; Homogeneous Turbulence

20100037235 NASA Langley Research Center, Hampton, VA, USA
CFL3D Contribution to the AIAA Supersonic Shock Boundary Layer Interaction Workshop
Rumsey, Christopher L.; October 2010; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08.07.20.14
Report No.(s): NASA/TM-2010-216858; L-19922; NF1676L-11451
ONLINE: http://hdl.handle.net/2060/20100037235
No Copyright; Avail.: CASI

This paper documents the CFL3D contribution to the AIAA Supersonic Shock Boundary Layer Interaction Workshop, held in Orlando, Florida in January 2010. CFL3D is a Reynolds-averaged Navier-Stokes code. Four shock boundary layer interaction cases are computed using a one-equation turbulence model widely used for other aerodynamic problems of interest. Two of the cases have experimental data available at the workshop, and two of the cases do not. The effect of grid, flux scheme, and thin-layer approximation are investigated. Comparisons are made to the available experimental data. All four cases exhibit strong three-dimensional behavior in and near the interaction regions, resulting from influences of the tunnel side-walls.
Author
Shock Layers; Supersonic Boundary Layers; Turbulence Models; Mathematical Models; Computational Fluid Dynamics

20100037834
Estimation of Seismic Load Demand for a Wind Turbine in the Time Domain: Preprint
Elgamai, A.; Uang, C.; Jonkman, J.; Prowell, I.; March 2010; 11 pp.; In English
Contract(s)/Grant(s): DE-AC36-08GO28308
Report No.(s): DE2010-974465; NREL/CP-500-47536
No Copyright; Avail.: Department of Energy Information Bridge

Turbines installed in seismically active regions such as the Pacific Rim or the Mediterranean must consider loads induced by base shaking from an earthquake. To account for this earthquake risk, current International Electrotechnical Commission (IEC) certification requirements provide a simplified method for calculating seismic loads which is intended to be conservative. Through the addition of capabilities, it is now possible to simulate earthquake loading of a wind turbine in conjunction other load sources such as wind and control system behavior using the FAST code. This paper presents a comparison of three earthquake loading scenarios of the National Renewable Energy Laboratory (NREL) offshore 5-MW baseline wind turbine: idling; continued operation through an earthquake; and an emergency shutdown initiated by an earthquake. Using a set of 22 earthquake records, simulations are conducted for each load case. A summary of the resulting tower moment demand is presented to assess the influence of operational state on the resulting structural demand.
NTIS
Loads (Forces); Wind Effects; Wind Turbines

20100037842
CFD Analysis of Core Bypass Phenomena
Johnson, R. W.; Sato, H.; Schultz, R. R.; March 2010; 49 pp.; In English
Contract(s)/Grant(s): DE-AC07-05ID14517
Report No.(s): DE2010-978363; INL/EXT-09-16882-REV-1
No Copyright; Avail.: National Technical Information Service (NTIS)

The U.S. Department of Energy is exploring the potential for the very high temperature gas-cooled reactor (VHTR), which will be either a prismatic or pebble-bed type reactor. One important design consideration for the reactor core of a prismatic VHTR is coolant bypass flow, which occurs in the interstitial regions between fuel blocks. Such gaps are an inherent presence in the reactor core because of tolerances in manufacturing the blocks and the inexact nature of their installation. Furthermore, the geometry of graphite blocks changes over the lifetime of the reactor because of thermal expansion and irradiation damage. The existence of the gaps induces a flow bias in the fuel blocks and results in unexpected increases in maximum fuel temperatures. Traditionally, simplified methods such as flow network calculations employing experimental correlations have been used to estimate flow and temperature distributions in the core design. However, the distribution of

temperature in the fuel pins and graphite blocks as well as coolant outlet temperatures are strongly coupled with the local heat generation rate within fuel blocks which is not uniformly distributed in the core. Hence, it is crucial to establish mechanistic based methods that can be applied to the reactor core thermal hydraulic design and safety analysis. Computational fluid dynamics (CFD) codes, which have a local physics based simulation capability, are widely used in various industrial fields. This study investigates core bypass flow phenomena with the assistance of commercial CFD codes and establishes a baseline for evaluation methods.
NTIS
Bypasses; Computational Fluid Dynamics; Gas Cooled Reactors

20100037963 NASA Johnson Space Center, Houston, TX, USA
Trade Study for 9 kW Water Membrane Evaporator
Bue, Grant C.; Ungar, Gene; Stephan, Ryan; [2010]; 1 pp.; In English; 41st International Conference on Environmental Systems, 17-21 Jul. 2011, Portland, OR, USA
Report No.(s): JSC-CN-22048
ONLINE: http://hdl.handle.net/2060/20100037963
No Copyright; Avail.: CASI; Abstract Only

Sublimators have been proposed and used in spacecraft for heat rejection. Sublimators are desirable heat rejection devices for short duration use because they can transfer large amounts of heat using little mass and are self-regulating devices. Sublimators reject heat into space by freezing water inside a porous substrate, allowing it to sublimate into vapor, and finally venting it into space. The state of the art thermal control system in orbiting spacecraft is a two loop, two fluid system. The external coolant loop typically uses a toxic single phase fluid that acquires heat from the spacecraft and rejects most of it via a radiator. The sublimator functions as a transient topper for orbiting spacecraft during day pass periods when radiator efficiency decreases. The sublimator interfaces with the internal loop through a built in heat exchanger. The internal loop fluid is non-toxic and is typically a propylene glycol and water solution with inhibitors to prevent corrosion with aluminum fins of the heat exchangers. Feedwater is supplied from a separate line to the sublimator to maintain temperature control of the cabin and vehicle hardware. Water membrane evaporators have been developed for spacecraft and spacesuits. They function similar to a sublimator but require a backpressure valve which could be actuated for this application with a simple fully open or fully closed modes. This technology would be applied to orbital thermal control (lunar or planetary). This paper details a trade study showing that evaporators would greatly reduce the consumable that is used, effectively wasted, by sublimators during start up and shut down during the topping phases of each orbit. State of the art for 9 kW sublimators reject about 870 W per kilogram of mass and 1150 W per liter of volume. If water with corrosion inhibitors is used the evaporators would be about 80% of the mass and volume of the equivalent system. The size and mass increases to about 110% if the internal fluid is 50% propylene glycol/50% water. The true benefit comes from the backpressure valve, that prevents the cyclical shutdown/startup loss of the sublimator and amounts to as much as 0.85 kg per orbit.
Author
Heat Transfer; Temperature Control; Water; Evaporation; Heat Exchangers; Cooling Systems; Spacecraft Design

20100038314 NASA Ames Research Center, Moffett Field, CA, USA
Development of Implicit Methods in CFD NASA Ames Research Center 1970's - 1980's
Pulliam, Thomas H.; January 28, 2010; 18 pp.; In English
Report No.(s): ARC-E-DAA-TN1210
ONLINE: http://hdl.handle.net/2060/20100038314
No Copyright; Avail.: CASI

The focus here is on the early development (mid 1970's-1980's) at NASA Ames Research Center of implicit methods in Computational Fluid Dynamics (CFD). A class of implicit finite difference schemes of the Beam and Warming approximate factorization type will be addressed. The emphasis will be on the Euler equations. A review of material pertinent to the solution of the Euler equations within the framework of implicit methods will be presented. The eigensystem of the equations will be used extensively in developing a framework for various methods applied to the Euler equations. The development and analysis

of various aspects of this class of schemes will be given along with the motivations behind many of the choices. Various acceleration and efficiency modifications such as matrix reduction, diagonalization and flux split schemes will be presented. Author

Computational Fluid Dynamics; Differential Equations; Factorization; Finite Difference Theory

37
MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20100037206 NASA Glenn Research Center, Cleveland, OH, USA

A Mass Computation Model for Lightweight Brayton Cycle Regenerator Heat Exchangers

Juhasz, Albert J.; September 2010; 20 pp.; In English; 8th International Energy Conversion Engineering Conference (IECEC), 25-28 Jul. 2010, Nashville, TN, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 199008.02.03.0663.09

Report No.(s): NASA/TM-2010-216799; AIAA Paper 2010-7087; E-17357-1

ONLINE: http://hdl.handle.net/2060/20100037206

No Copyright; Avail.: CASI

Based on a theoretical analysis of convective heat transfer across large internal surface areas, this paper discusses the design implications for generating lightweight gas-gas heat exchanger designs by packaging such areas into compact three-dimensional shapes. Allowances are made for hot and cold inlet and outlet headers for assembly of completed regenerator (or recuperator) heat exchanger units into closed cycle gas turbine flow ducting. Surface area and resulting volume and mass requirements are computed for a range of heat exchanger effectiveness values and internal heat transfer coefficients. Benefit cost curves show the effect of increasing heat exchanger effectiveness on Brayton cycle thermodynamic efficiency on the plus side, while also illustrating the cost in heat exchanger required surface area, volume, and mass requirements as effectiveness is increased. The equations derived for counterflow and crossflow configurations show that as effectiveness values approach unity, or 100 percent, the required surface area, and hence heat exchanger volume and mass tend toward infinity, since the implication is that heat is transferred at a zero temperature difference. To verify the dimensional accuracy of the regenerator mass computational procedure, calculation of a regenerator specific mass, that is, heat exchanger weight per unit working fluid mass flow, is performed in both English and SI units. Identical numerical values for the specific mass parameter, whether expressed in lb/(lb/sec) or kg/ (kg/sec), show the dimensional consistency of overall results.

Author

Heat Exchangers; Temperature Effects; Brayton Cycle; Convective Heat Transfer; Gas-Gas Interactions; Thermodynamic Efficiency; Closed Cycles; Regenerators

20100037810

Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, July 2010, NR-005d

July 2010; 47 pp.; In English

Report No.(s): PB2010-114760; EPA/420/R-10/016

No Copyright; Avail.: National Technical Information Service (NTIS)

EPAs NONROAD model computes emission inventories for nonroad engines. This report documents the default input values of median life, annual activity, and load factor for various types of nonroad engines. The model uses annual activity and load factor values to calculate yearly emissions for each engine type. In addition, the model uses activity and load factor, in combination with median life, to calculate the fleet age distributions for each engine type, as it projects future (or past) engine populations. Relative to the previous April 2004 version of this report, this version includes median life, activity, and load factor estimates for high performance sterndrive and inboard (SD/I) recreational marine engines. Also, beginning with NONROAD2005, the hydro power unit SCCs have been changed from 22xx005050 to 22xx006035, reflecting a reclassification from the farm to the commercial category.

NTIS

Air Pollution; Combustion Products; Exhaust Emission; Exhaust Gases; Loads (Forces)

20100037812

Exhaust Emission Factors for Nonroad Engine Modeling: Spark-Ignition, July 2010, NR-010f

July 2010; 58 pp.; In English

Report No.(s): PB2010-114762; EPA/420/R-10/019

No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes and documents exhaust emission factors, crankcase estimates, and brake specific fuel consumption (BSFC) estimates used for spark ignition (SI) engines in EPAs final NONROAD2008a emission inventory model. It covers engines powered by gasoline, natural gas and liquefied petroleum gas. Relative to the December 2005 version of this report, this version has been updated to incorporate the standards in the 2008 final rulemaking affecting small nonroad SI engines and equipment, as well as marine SI engines and vessels.

NTIS

Exhaust Emission; Internal Combustion Engines; Spark Ignition

20100037813

Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling: Compression-Ignition, July 2010, NR-009d

July 2010; 141 pp.; In English

Report No.(s): PB2010-114763; EPA/420/R-10/018

No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes and documents exhaust emission factors used for compression ignition (CI) engines in the U.S. Environmental Protection Agencys (EPA) final NONROAD2008a emission inventory model. The term compression ignition is synonymous with diesel for the purposes of this report. Pollutants covered include hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NOx), particulate matter (PM), carbon dioxide (CO2), and sulfur dioxide (SO2). Brake specific fuel consumption (BSFC), which is a fuel rate measurement, is also discussed. All PM emissions are assumed to be smaller than 10 microns (PM10) and 97% of the PM is assumed to be smaller than 2.5 microns (PM2.5). The NONROAD Reporting Utility allows the user to select which of these two size ranges is reported. Relative to the previous April 2004 version of this report, this version has been updated to include the Tier 3 standards for recreational marine diesel engines, along with technology name changes for this source category.

NTIS

Diesel Engines; Engine Parts; Exhaust Emission; Ignition; Inventories

20100037815

Nonroad Spark-Ignition Engine Emission Deterioration Factors, July 2010, NR-011d

July 2010; 17 pp.; In English

Report No.(s): PB2010-114765; EPA/420/R-10/020

No Copyright; Avail.: National Technical Information Service (NTIS)

This report addresses the emission deterioration rates for spark-ignition engines used in the final NONROAD2008a model. The specific deterioration inputs used in NONROAD and their basis will be addressed for land-based spark-ignition engines at or below 25 horsepower, land-based spark-ignition engines over 25 horsepower, recreational equipment, and recreational marine spark-ignition engines using gasoline. Deterioration is also addressed for land-based liquid petroleum gas (LPG) and compressed natural gas engines (CNG). Deterioration inputs for compression-ignition (diesel) engines are addressed in the report, Exhaust Emission Factors for Nonroad Engine Modeling - Compression Ignition (NR-009d). Relative to the December 2005 version of this report, this version has been updated to incorporate the deterioration rates corresponding to the Phase 3 exhaust standards in the 2008 final rulemaking affecting small nonroad nonhandheld SI engines and equipment, as well as the 2010 exhaust standards for marine SI engines and vessels. It describes updates to the deterioration rates for nonhandheld Phase 2 engines. It also reflects new technology type names assigned to offroad motorcycles, all-terrain vehicles, and snowmobiles.

NTIS

Deterioration; Exhaust Emission; Internal Combustion Engines; Spark Ignition

38
QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20100037185 NASA Johnson Space Center, Houston, TX, USA
Risk Informed Design as Part of the Systems Engineering Process
Deckert, George; October 14, 2010; 26 pp.; In English; Commercial Human Spacefllight Symposium, 13-15 Oct. 2010, Houston, TX, USA; Original contains color illustrations
Report No.(s): JSC-CN-21735
ONLINE: http://hdl.handle.net/2060/20100037185
No Copyright; Avail.: CASI

This slide presentation reviews the importance of Risk Informed Design (RID) as an important feature of the systems engineering process. RID is based on the principle that risk is a design commodity such as mass, volume, cost or power. It also reviews Probabilistic Risk Assessment (PRA) as it is used in the product life cycle in the development of NASA's Constellation Program.

CASI
Risk; Risk Assessment; Systems Engineering; Reliability; Failure Analysis; Risk Management; Design Optimization

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20100036812 NASA Dryden Flight Research Center, Edwards, CA, USA
SOFIA 747-SP: Structural Dynamics Overview
Ginn, Star Renee; May 06, 2010; 28 pp.; In English; NESC Loads and Dynamics Face-To-Face, 6 May 2010, Waco, TX, USA; Original contains color illustrations
Report No.(s): DFRC-E-DAA-TN1620
ONLINE: http://hdl.handle.net/2060/20100036812
No Copyright; Avail.: CASI

Oral/visual presentation sharing an overview of the structural dynamics of the SOFIA 747-SP.

Author
Dynamic Structural Analysis; SOFIA (Airborne Observatory); General Overviews; Aeroelasticity; Flight Tests; Aircraft Models

20100037832
Bridge Deck Integrity Measurements for Asset Management
Rosenblad, B.; Washer, G.; Goetz, R.; June 2009; 43 pp.; In English
Report No.(s): PB2010-115109; MTC/PROJECT-2007-03
No Copyright; Avail.: National Technical Information Service (NTIS)

This project investigated the application and implementation of stress-wave-based methods for assessing the integrity of concrete bridge decks. The ultimate objective is to develop reliable and economical non-destructive evaluation (NDE) techniques that evaluate the condition of concrete bridge decks in the field with limited traffic disruption. Experimental and theoretical studies were conducted on guided stress waves (Lamb waves) in concrete plates. Field measurements were performed on a full-scale concrete bridge deck located at the Remote Testing Facility (RTF) at the University of Missouri, Columbia. Measurements were performed using a variety of sensor and source orientations, including the placement of sensors on the opposite side of the concrete deck from the source. Energy was excited using vertically and horizontally oriented broadband source impacts. Dispersion curves were successfully developed from a single-sensor, multi-impact approach and a frequency-wavenumber transformation procedure. The dispersion curves that were developed demonstrated the ability to detect and separate multiple Lamb wave modes that could be used to infer the thickness and Rayleigh wave velocity of the concrete deck. A second series of field experiments was performed on a concrete element containing simulated defects at several depths. The implementation of the approach described above proved ineffective for clearly detecting the presence and

depth of the flaws. Additional measurements of Lamb waves propagating past the subsurface defects demonstrated the potential to identify the presence and depth of flaws based on changes in the frequency content of the wave. These measurements have provided valuable insight into potential means to implement stress-wave measurements for defect detection in bridge decks.
NTIS
Concretes; Bridges (Landforms); Structural Analysis; Stress Waves

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20100036717 NASA Ames Research Center, Moffett Field, CA, USA
The Eons of Chaos and Hades
Goldblatt, C.; Zahnle, K. J.; Sleep, N. H.; Nisbet, E. G.; Solid Earth; February 02, 2010; Volume 1, No. 1, pp. 1-3; In English
Contract(s)/Grant(s): NNH06CC03B
Report No.(s): ARC-E-DAA-TN1522
ONLINE: http://hdl.handle.net/2060/20100036717; http://dx.doi.org/10.5194/se-1-1-2010; http://www.solid-earth.net/1/1/2010/
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We propose the Chaotian Eon to demarcate geologic time from the origin of the Solar System to the Moonforming impact on Earth. This separates the solar system wide processes of planet formation from the subsequent divergent evolution of the inner planets. We further propose the division of the Hadean Eon into eras and periods and naming the proto-Earth Tellus.
Author
Geochronology; Solar System; Precambrian Period; Earth (Planet); Planetary Geology

20100036753 NASA Ames Research Center, Moffett Field, CA, USA
LCROSS: Volatiles and Exosphere Associated with a Permanently Shadowed Region in Cabeus
Wooden, Diane; Colaprete, Anthony; Heldmann, Jennifer; Ennico, Kimberly; Shirley, Mark; Marshall, William; June 05, 2010; 2 pp.; In English; 3rd Annual NASA Lunar Science Forum 2010, 20-22 Jul. 2010, Moffett Field, CA, USA
Contract(s)/Grant(s): WBS 811073.02.04.02.92
Report No.(s): ARC-E-DAA-TN1703
ONLINE: http://hdl.handle.net/2060/20100036753
Copyright; Distribution as joint owner in the copyright; Avail.: CASI; Abstract Only

We discuss the volatile species in the LCROSS data set in addition to water that were observed by the LCROSS Shepherding Spacecraft before its own demise in the four minutes following the first impact by the Centaur. The stochastic nature of the temporal variations observed by the nadir-viewing near-infrared spectrometer combined with the diversity of the volatile species suggests that these species were in situ in the permanently shadowed crater and were released by a combination of the centaur impact and the resulting warming of the regolith by the impact and ejecta debris blanket. Adding to this intrigue are the pre-impact observations by the UVVisual spectrometer that reveal that the field-of-view into the permanently shadowed crater contains UV emission lines, The UV lines are clearly revealed once the descent of the shepherding spacecraft narrows the field-of-view of the UV-Vis spectrometer so as to exclude any surrounding bright terrain. Our suggestion is that this emission comes from tenuous gases, i.e., there appears to be a potential association between the cold, permanently shadowed region and an exosphere.
Author
Exosphere; LCROSS (Satellite); Volatility; Centaur Launch Vehicle; Ultraviolet Radiation

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20100036784 NASA Ames Research Center, Moffett Field, CA, USA

Sources of Uncertainty in Predicting Land Surface Fluxes Using Diverse Data and Models

Dungan, Jennifer L.; Wang, Weile; Michaelis, Andrew; Votava, Petr; Nemani, Ramakrishma; July 22, 2010; 4 pp.; In English; 9th International Symposium on Spatial Accuracy Assessmentin Natural Resources and Environmental Sciences, 20-23 Jul. 2010, Leicester, England, UK; Original contains color illustrations

Contract(s)/Grant(s): NNA07CN16A; WBS 281945.02.61.01.71

Report No.(s): ARC-E-DAA-TN1640

ONLINE: http://hdl.handle.net/2060/20100036784

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In the domain of predicting land surface fluxes, models are used to bring data from large observation networks and satellite remote sensing together to make predictions about present and future states of the Earth. Characterizing the uncertainty about such predictions is a complex process and one that is not yet fully understood. Uncertainty exists about initialization, measurement and interpolation of input variables; model parameters; model structure; and mixed spatial and temporal supports. Multiple models or structures often exist to describe the same processes. Uncertainty about structure is currently addressed by running an ensemble of different models and examining the distribution of model outputs. To illustrate structural uncertainty, a multi-model ensemble experiment we have been conducting using the Terrestrial Observation and Prediction System (TOPS) will be discussed. TOPS uses public versions of process-based ecosystem models that use satellite-derived inputs along with surface climate data and land surface characterization to produce predictions of ecosystem fluxes including gross and net primary production and net ecosystem exchange. Using the TOPS framework, we have explored the uncertainty arising from the application of models with different assumptions, structures, parameters, and variable definitions. With a small number of models, this only begins to capture the range of possible spatial fields of ecosystem fluxes. Few attempts have been made to systematically address the components of uncertainty in such a framework. We discuss the characterization of uncertainty for this approach including both quantifiable and poorly known aspects.

Author

Uncertain Systems; Earth Surface; Prediction Analysis Techniques; Ecosystems; Environment Models

20100037236 NASA Langley Research Center, Hampton, VA, USA

CALIOP Version 3 Data Products: A Comparison to Version 2

Vaughan, Mark; Omar, Ali; Hunt, Bill; Getzewich, Brian; Tackett, Jason; Powell, Kathy; Avery, Melody; Kuehn, Ralph; Young, Stuart; Hu, Yong; Liu, Zhaoyan; Trepte, Chip; Winker, Dave; Lucker, Pat; Lee, Kam-Pui; Howell, Joe; Lamberth, Jim; October 25, 2010; 1 pp.; In English; International Symposium on the A-Train Satellite Constellation 2010, 25-28 Oct. 2010, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 653967.04.12.01

Report No.(s): NF1676L-11590

ONLINE: http://hdl.handle.net/2060/20100037236

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After launch we discovered that the CALIOP daytime measurements were subject to thermally induced beamdrift,and this caused the calibration to vary by as much as 30% during the course of a single daytime orbit segment. Using an algorithm developed by Powell et al.(2010), empirically derived correction factors are now computed in near realtime as a function of orbit elapsed time, and these are used to compensate for the beam wandering effects.

Derived from text

Algorithms; Clouds (Meteorology); Aerosols; Data Products

20100037770 NASA Langley Research Center, Hampton, VA, USA

Lidar Ratios for Dust Aerosols Derived From Retrievals of CALIPSO Visible Extinction Profiles Constrained by Optical Depths from MODIS-Aqua and CALIPSO/CloudSat Ocean Surface Reflectance Measurements

Young, Stuart A.; Josset, Damien B.; Vaughan, Mark A.; October 25, 2010; 1 pp.; In English; International Symposium on the A-Train Satellite Constellation 2010, 25-28 Oct. 2010, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 653967.04.12.01

Report No.(s): NF1676L-11603

ONLINE: http://hdl.handle.net/2060/20100037770

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CALIPSO's (Cloud Aerosol Lidar Infrared Pathfinder Satellite Observations) analysis algorithms generally require the use of tabulated values of the lidar ratio in order to retrieve aerosol extinction and optical depth from measured profiles of attenuated backscatter. However, for any given time or location, the lidar ratio for a given aerosol type can differ from the tabulated value. To gain some insight as to the extent of the variability, we here calculate the lidar ratio for dust aerosols using aerosol optical depth constraints from two sources. Daytime measurements are constrained using Level 2, Collection 5, 550-nm aerosol optical depth measurements made over the ocean by the MODIS (Moderate Resolution Imaging Spectroradiometer) on board the Aqua satellite, which flies in formation with CALIPSO. We also retrieve lidar ratios from night-time profiles constrained by aerosol column optical depths obtained by analysis of CALIPSO and CloudSat backscatter signals from the ocean surface.

Derived from text

CALIPSO (Pathfinder Satellite); Imaging Spectrometers; Ocean Surface; Optical Radar; Optical Thickness; Spectral Reflectance

44
ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *28 Propellants and Fuels*.

20100037835

Large-Scale Wind and Solar Integration in Germany

Ernst, B.; Schreier, U.; Berster, F.; Pease, J. H.; Scholz, C.; February 2010; 52 pp.; In English

Contract(s)/Grant(s): DE-AC05-76RL01830

Report No.(s): DE2010-977319; PNNL-19225

No Copyright; Avail.: National Technical Information Service (NTIS)

This report provides key information concerning the experience of two German transmission system operators with the integration of 25 gigawatts of wind and 7 gigawatts of solar power capacity into their systems, along with their efforts to mitigate its impacts on the electric power system. The report has been prepared based on information provided by managers and engineers from Amprion GmbH and 50Hertz Transmission GmbH to representatives from the Bonneville Power Administration (BPA) and Pacific Northwest National Laboratory (PNNL) during their visit to Germany in October 2009. The trip and this report have been sponsored by BPAs Technology Innovation office. Learning from the German experience could help BPA engineers to compare and evaluate potential new solutions for managing higher penetrations of wind energy resources in their control area. A broader dissemination of this experience will benefit wind and solar resource integration efforts in the USA.

NTIS

Electric Generators; Electric Power Plants; Germany; Large Scale Integration; Solar Energy; Windpower Utilization

45
ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20100036743 NASA Johnson Space Center, Houston, TX, USA
STS 131 Return Samples: Assessment of Air Quality Aboard the Shuttle (STS-131) and International Space Station (19A)
James, John T.; [2010]; 2 pp.; In English; Original contains color illustrations
Report No.(s): JSC-CN-21942
ONLINE: http://hdl.handle.net/2060/20100036743
No Copyright; Avail.: CASI

The toxicological assessments of 1 grab sample canister (GSC) from the Shuttle are reported in Table 1. Analytical methods have not changed from earlier reports. The recoveries of the 3 surrogates (C-13-acetone, fluorobenzene, and chlorobenzene) from the Shuttle GSC were 100%, 93%, and 101%, respectively. Based on the historical experience using end-of-mission samples, the Shuttle atmosphere was acceptable for human respiration.
Derived from text
Air Quality; International Space Station; Space Transportation System; Sample Return Missions; Toxicology

20100037809
Conversion Factors for Hydrocarbon Emission Components, July 2010, NR-002d
July 2010; 6 pp.; In English
Report No.(s): PB2010-114759; EPA/420/R-10/015
No Copyright; Avail.: National Technical Information Service (NTIS)

The purpose of this memorandum is to document the conversion factors for reporting hydrocarbon emissions in different forms. The general forms are total hydrocarbons (THC), total organic gas (TOG), nonmethane hydrocarbons (NMHC), nonmethane organic gas (NMOG), and volatile organic compounds (VOC), all defined in the introduction below. For reporting hydrocarbon emissions from nonroad equipment, it is helpful to provide an accepted means to estimate the hydrocarbons in the different forms. This is not a substitute for full speciation of hydrocarbon emissions. Although the conversion factors in the model have not changed relative to the previous NONROAD2005 version, this technical report has been corrected to properly state that the exhaust conversion factors are applied to the crankcase emissions.
NTIS
Air Pollution; Exhaust Emission; Hydrocarbons

20100037811
Nonroad Engine Population Estimates, July 2010, NR-006e
July 2010; 48 pp.; In English
Report No.(s): PB2010-114761; EPA/420/R-10/017
No Copyright; Avail.: National Technical Information Service (NTIS)

The purpose of this memorandum is to document the source of the nonroad engine population values used in EPAs final NONROAD2008a emission inventory model. Engine populations are provided as default values in EPAs NONROAD emission inventory model categorized by equipment type, power level, and fuel type. This categorization allows the NONROAD model to determine the phase-in of new emission standards and other unique aspects of emissions or allocations by application, fuel type, or power level. Relative to the previous December 2005 version of this report, this version includes population estimates for high performance sterndrive and inboard (SD/I) recreational marine engines.
NTIS
Estimates; Inventories; Populations

20100037814
Nonroad Evaporative Emission Rates, July 2010, NR-012d
July 2010; 147 pp.; In English
Report No.(s): PB2010-114764; EPA/420/R-10/021
No Copyright; Avail.: National Technical Information Service (NTIS)

This report documents the basic evaporative emission assumptions and calculations used in EPAs final NONROAD2008a

emissions model. The types of evaporative emissions covered in this report include diurnal, tank permeation, hose permeation, hot soak, and running losses. Separate reports address displacement and spillage from refueling (NR-013b) and crankcase emissions (NR-010f). Relative to the December 2005 version of this report, this version has been updated to incorporate the standards in the 2008 final rulemaking affecting small nonroad SI engines and equipment, as well as marine SI engines and vessels. It also describes updates to some of the pre-control emission rates, as well as the new ability of NONROAD2008a to specifically model the effects of ethanol blends on fuel tank and hose permeation losses.
NTIS
Exhaust Emission; Permeating; Fuel Tanks; Refueling

20100037830
Assessment of Health Impacts of Particulate Matter from Indoor Air Sources Phase I: Development of In Vitro Methodology. Final Report
Matsumura, F.; Vogel, C. F.; Kobayashi, R.; Liu, X.; Wong, P.; April 2010; 137 pp.; In English
Report No.(s): PB2010-114915
No Copyright; Avail.: National Technical Information Service (NTIS)

The overall objective of this study was to develop approaches to assess the toxicities of several major indoor particulate matter (PM) source samples by using human in vitro cell models with a focus on inflammatory and oxidative stress responses. In the pilot study, the capacity of extracts from incense PM to stimulate inflammatory marker production in four in vitro human cell models was evaluated. The U937 macrophage cell line was the most sensitive of the test models followed by the NCI-H441 bronchiolar Clara cell line. PM toxicity from cooking activities, candle burning, wood burning, and incense burning was assessed in both cell models. All indoor PM sample source types had some positive response in either or both of the human cell lines with incense producing the largest responses. In further analytical studies, it was determined that incense PM contained high levels of PAHs while wood smoke had lower levels. Incense also was found to contain many other compounds such as vanillin which may contribute to its high toxicity. Wood smoke yielded hydrocarbons containing a series of siloxanes. Cooking PM sample from the stir frying contained mainly hydrocarbons related to the oil used. The candle samples consisted of numerous hydrocarbons such as alkanes and alkenes.
NTIS
Health; In Vitro Methods and Tests; Indoor Air Pollution; Particulates

20100037844
Air Quality Modeling Technical Support Document: National Emission Standards for Hazardous Air Pollutants from the Portland Cement Manufacturing Industry
July 2010; 14 pp.; In English
Report No.(s): PB2010-113226; EPA/454/R-10/004
No Copyright; Avail.: National Technical Information Service (NTIS)

This document describes the air quality modeling performed by EPA in support of the Portland Cement NESHAP. A national scale air quality modeling analysis was performed to estimate the impact of the sector emissions changes on future year: annual and 24-hour PM2.5 concentrations, total mercury deposition, as well as visibility impairment. Air quality benefits are estimated with the Comprehensive Air Quality Model with Extensions (CAMx) model. CAMx simulates the numerous physical and chemical processes involved in the formation, transport, and destruction of ozone, particulate matter and air toxics. In addition to the CAMx model, the modeling platform includes the emissions, meteorology, and initial and boundary condition data which are inputs to this model. Emissions and air quality modeling decisions are made early in the analytical process. For this reason, it is important to note that the inventories used in the air quality modeling and the benefits modeling are slightly different than the final adjusted cement kiln sector inventories presented in the RIA. However, the air quality inventories and the final rule inventories are generally consistent, so the air quality modeling adequately reflects the effects of the rule.
NTIS
Air Pollution; Air Quality; Cements; Environment Models; Exhaust Emission; Exhaust Gases; Industries; Manufacturing; Pollution Control; Standards

20100037868

Brief Technical Critique of Ehlig-Economides and Economides 2010: Sequestering Carbon Dioxide in a Closed Underground Volume

Dooley, J. L.; Davidson, C. L.; April 2010; 12 pp.; In English

Contract(s)/Grant(s): DE-AC05-76RLO1830

Report No.(s): DE2010-976985; PNNL-19249

No Copyright; Avail.: Department of Energy Information Bridge

In their 2010 paper,'Sequestering Carbon Dioxide in a Close Underground Volume,' authors Ehlig-Economides and Economides assert that 'underground carbon dioxide sequestration via bulk CO2 injection is not feasible at any cost.' The authors base this conclusion on a number of assumptions that the peer reviewed technical literature and decades of carbon dioxide (CO2) injection experience have proven invalid. In particular, the paper is built upon two flawed premises: first, that effective CO2 storage requires the presence of complete structural closure bounded on all sides by impermeable media, and second, that any other storage system is guaranteed to leak. These two assumptions inform every aspect of the authors' analyses, and without them, the paper fails to prove its conclusions. The assertion put forward by Ehlig-Economides and Economides that anthropogenic CO2 cannot be stored in deep geologic formations is refuted by even the most cursory examination of the more than 25 years of accumulated commercial carbon dioxide capture and storage experience.

NTIS

Carbon Dioxide; Closures

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20100036838 NASA Ames Research Center, Moffett Field, CA, USA

Design and Evaluation of a Dynamic Programming Flight Routing Algorithm Using the Convective Weather Avoidance Model

Ng, Hok K.; Grabbe, Shon; Mukherjee, Avijit; August 10, 2010; 13 pp.; In English; AIAA Guidance, Navigation, and Control Conference, 10 -13 Aug. 2009, Chicago, IL, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 411931.02.41.01

Report No.(s): AIAA Paper 2009-5862; ARC-E-DAA-TN800

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The optimization of traffic flows in congested airspace with varying convective weather is a challenging problem. One approach is to generate shortest routes between origins and destinations while meeting airspace capacity constraint in the presence of uncertainties, such as weather and airspace demand. This study focuses on development of an optimal flight path search algorithm that optimizes national airspace system throughput and efficiency in the presence of uncertainties. The algorithm is based on dynamic programming and utilizes the predicted probability that an aircraft will deviate around convective weather. It is shown that the running time of the algorithm increases linearly with the total number of links between all stages. The optimal routes minimize a combination of fuel cost and expected cost of route deviation due to convective weather. They are considered as alternatives to the set of coded departure routes which are predefined by FAA to reroute pre-departure flights around weather or air traffic constraints. A formula, which calculates predicted probability of deviation from a given flight path, is also derived. The predicted probability of deviation is calculated for all path candidates. Routes with the best probability are selected as optimal. The predicted probability of deviation serves as a computable measure of reliability in pre-departure rerouting. The algorithm can also be extended to automatically adjust its design parameters to satisfy the desired level of reliability.

Author

Algorithms; Dynamic Programming; Flight Paths; Weather; Air Traffic Control; Mathematical Models

20100037227 Dalhousie Univ., Halifax, Nova Scotia, Canada

Efficient Formation of Stratospheric Aerosol for Climate Engineering by Emission of Condensible Vapor from Aircraft

Pierce, Jeffrey R.; Weisenstein, Debra K.; Heckendorn, Patricia; Peter. Thomas; Keith, David W.; Geophysical Research Letters; September 22, 2010; ISSN 0094-8276; Volume 37; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NNH08CD20C

ONLINE: http://dx.doi.org/10.1029/2010GL043975

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Recent analysis suggests that the effectiveness of stratospheric aerosol climate engineering through emission of non-condensable vapors such as SO2 is limited because the slow conversion to H2SO4 tends to produce aerosol particles that are too large; SO2 injection may be so inefficient that it is difficult to counteract the radiative forcing due to a CO2 doubling. Here we describe an alternate method in which aerosol is formed rapidly in the plume following injection of H2SO4, a condensable vapor, from an aircraft. This method gives better control of particle size and can produce larger radiative forcing with lower sulfur loadings than SO2 injection. Relative to SO2 injection, it may reduce some of the adverse effects of geoengineering such as radiative heating of the lower stratosphere. This method does not, however, alter the fact that such a geoengineered radiative forcing can, at best, only partially compensate for the climate changes produced by CO2.

Author

Aerosols; Climate; Condensing; Stratosphere; Vapors

20100037803

Water, Climate Change, and Forest: Watershed Stewardship for a Changing Climate

Furniss, M. J.; Staab, B. P.; Hazelhurst, S.; Clifton, C. F.; Roby, K. B.; June 2010; 80 pp.; In English

Report No.(s): PB2010-114441; PNW-GTR-812

No Copyright; Avail.: National Technical Information Service (NTIS)

Water from forested watersheds provides irreplaceable habitat for aquatic and riparian species and supports our homes, farms, industries, and energy production. Secure, high-quality water from forests is fundamental to our prosperity and our stewardship responsibility. Yet population pressures, land uses, and rapid climate change combine to seriously threaten these waters and the resilience of watersheds in most places. Forest land managers are expected to anticipate and respond to these threats and steward forested watersheds to ensure the sustained protection and provision of water and the services it provides. Effective, constructive watershed stewardship requires that we think, collaborate, and act. We think to understand the values at risk and how watersheds can remain resilient, and we support our thinking with knowledge sharing and planning. We collaborate to develop common understandings and goals for watersheds and a robust, durable capacity for response that includes all stakeholders and is guided by science. We act to secure and steward resilient watersheds that will continue to provide crucial habitats and water supplies in the coming century by implementing practices that protect, maintain, and restore watershed processes and services.

NTIS

Climate; Climate Change; Forests; Water; Watersheds

51
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20100036715 NASA Ames Research Center, Moffett Field, CA, USA

OMEGA (Offshore Membrane for Enclosing Algae). NASA-NAVY: A Strategic Planning Discussion

Trent, Jonathan; March 25, 2010; 13 pp.; In English; Original contains color illustrations

Report No.(s): ARC-E-DAA-TN1476

ONLINE: http://hdl.handle.net/2060/20100036715

No Copyright; Avail.: CASI

This briefing packet provides a short introduction to OMEGA and a truncated version of our project approach, with an example of the kind of work break down structure (WBS) used to guide our Phase I activities. It is meant to give you an impression of how we are approaching the challenge of creating the world's first marine photobioreactor (PBR) that will scale to address the strategic energy problems confronting the USA and the world. Some of our conceptual PBR designs and plans

for logistics are included to communicate the path we have taken. We have also included an aerial photograph of the experimental tanks we are using at the Cal Fish and Game, followed by concluding remarks. The overarching purpose of the strategic planning discussion in Norfolk is to establish the relationship between the NASA OMEGA Team and the Navy, to unite the strengths of both agencies, and to map a mutual way forward along the project's established critical path.
Author
Algae; Management Planning; Membranes; Feasibility Analysis; Bioreactors; Offshore Platforms

20100036716 NASA Ames Research Center, Moffett Field, CA, USA
OMEGA for the Future of Biofuels: OMEGA for the Future
Trent, Jonathan; March 17, 2010; 109 pp.; In English; Original contains color illustrations
Report No.(s): ARC-E-DAA-TN1425
ONLINE: http://hdl.handle.net/2060/20100036716
No Copyright; Avail.: CASI

Presentation on algae and sustainability of the earth. Discusses the Offshore Membrane Enclosures for Growing Algae (OMEGA).
Author
Algae; Membranes; Offshore Platforms; Energy Technology

20100037955 NASA Johnson Space Center, Houston, TX, USA
The History of the Animal Care Program at NASA Johnson Space Center
Khan-Mayberry, Noreen; Bassett, Stephanie; October 15, 2010; 28 pp.; In English; AALAS Anual Meeting, 15 Oct. 2010, Atlanta, GA, USA; Original contains color illustrations
Report No.(s): JSC-CN-21846
ONLINE: http://hdl.handle.net/2060/20100037955
No Copyright; Avail.: CASI

This slide presentation reviews the work of the Animal Care Program (ACP). Animals have been used early in space exploration to ascertain if it were possible to launch a manned spacecraft. The program is currently involved in many studies that assist in enhancing the scientific knowledge of the effect of space travel. The responsibilities of the ACP are: (1) Organize and supervise animal care operations & activities (research, testing & demonstration). (2) Maintain full accreditation by the International Association for the Assessment and Accreditation of Laboratory Animal Care (AAALAC) (3) Ensure protocol compliance with IACUC recommendations (4) Training astronauts for in-flight animal experiments (5) Maintain accurate & timely records for all animal research testing approved by JSC IACUC (6) Organize IACUC meetings and assist IACUC members (7) Coordinate IACUC review of the Institutional Program for Humane Care and Use of Animals (every 6 mos) CASI
Animals; Space Exploration; Animal Models; Bioastronautics; Biological Effects

20100038353 NASA Johnson Space Center, Houston, TX, USA
Correlation of Wissler Human Thermal Model Blood Flow and Shiver Algorithms
Bue, Grant; Makinen, Janice; Cognata, Thomas; [2010]; 1 pp.; In English; 41st International Conference on Environmental Systems (ICES), 17 Jul. 2011, Portland, OR, USA
Report No.(s): JSC-CN-22045
ONLINE: http://hdl.handle.net/2060/20100038353
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The Wissler Human Thermal Model (WHTM) is a thermal math model of the human body that has been widely used to predict the human thermoregulatory response to a variety of cold and hot environments. The model has been shown to predict core temperature and skin temperatures higher and lower, respectively, than in tests of subjects in crew escape suit working in a controlled hot environments. Conversely the model predicts core temperature and skin temperatures lower and higher, respectively, than in tests of lightly clad subjects immersed in cold water conditions. The blood flow algorithms of the model has been investigated to allow for more and less flow, respectively, for the cold and hot case. These changes in the model have yielded better correlation of skin and core temperatures in the cold and hot cases. The algorithm for onset of shiver did not need to be modified to achieve good agreement in cold immersion simulations
Author
Blood Flow; Physiological Responses; Thermoregulation; Body Temperature; Human Reactions; Algorithms

20100038364 Columbia Univ., New York, NY, USA

A New View of Radiation-Induced Cancer: Integrating Short-and Long-Term Processes. Part I: Approach

Shuryak, Igor; Hahnfeldt, Philip; Hlatky, Lynn; Sachs, Rainer K.; Brenner, David J.; Radiation and Environmental Biophysics; [2009]; Volume 48, No. 3, pp. 263-274; In English; Original contains color illustrations

Contract(s)/Grant(s): NNJ06HA27G

ONLINE: http://dx.doi.org/10.1007/s00411-009-0230-3

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Mathematical models of radiation carcinogenesis are important for understanding mechanisms and for interpreting or extrapolating risk. There are two classes of such models: (1) long-term formalisms that track premalignant cell numbers throughout an entire lifetime but treat initial radiation dose-response simplistically and (2) short-term formalisms that provide a detailed initial dose-response even for complicated radiation protocols, but address its modulation during the subsequent cancer latency period only indirectly. We argue that integrating short- and long-term models is needed. As an example of this novel approach, we integrate a stochastic short-term initiation/ inactivation/repopulation model with a deterministic two-stage long-term model. Within this new formalism, the following assumptions are implemented: radiation initiates, promotes, or kills pre-malignant cells; a pre-malignant cell generates a clone, which, if it survives, quickly reaches a size limitation; the clone subsequently grows more slowly and can eventually generate a malignant cell; the carcinogenic potential of pre-malignant cells decreases with age.

Author

Cancer; Extrapolation; Mathematical Models; Stochastic Processes; Carcinogens

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20100036760 NASA Johnson Space Center, Houston, TX, USA

The International Space Station: A Low-Earth Orbit (LEO) Test Bed for Advancements in Space and Environmental Medicine

Ruttley, Tara M.; Robinson, Julie A.; October 18, 2010; 1 pp.; In English; International Congress of Medicine in Space and Extreme Environments, 18-21 Oct. 2010, Berlin, Germany

Report No.(s): JSC-CN-20642

ONLINE: http://hdl.handle.net/2060/20100036760

No Copyright; Avail.: CASI; Abstract Only

Ground-based space analog projects such as the NASA Extreme Environment Mission Operations (NEEMO) can be valuable test beds for evaluation of experimental design and hardware feasibility before actually being implemented on orbit. The International Space Station (ISS) is an closed-system laboratory that orbits 240 miles above the Earth, and is the ultimate extreme environment. Its inhabitants spend hours performing research that spans from fluid physics to human physiology, yielding results that have implications for Earth-based improvements in medicine and health, as well as those that will help facilitate the mitigation of risks to the human body associated with exploration-class space missions. ISS health and medical experiments focus on pre-flight and in-flight prevention, in-flight treatment, and postflight recovery of health problems associated with space flight. Such experiments include those on enhanced medical monitoring, bone and muscle loss prevention, cardiovascular health, immunology, radiation and behavior. Lessons learned from ISS experiments may not only be applicable to other extreme environments that face similar capability limitations, but also serve to enhance standards of care for everyday use on Earth.

Author

International Space Station; Low Earth Orbits; NASA Programs; Space Missions; Test Stands; Aerospace Medicine; Experiment Design

20100037111 NASA Dryden Flight Research Center, Edwards, CA, USA

A Computational Biology Approach to Modelling and Identification of Human Physiology

Kukreja, Sunil L.; June 30, 2010; 79 pp.; In English; ICNPAA 2010 World Congress: 8th International Conference on Mathematical Problems in Engineering, Aerospace and Sciences, 30 Jun. - 3 Jul. 2010, Sao Jose dos Campos, Brazil; Original contains color illustrations

Report No.(s): DFRC-E-DAA-TN1674

ONLINE: http://hdl.handle.net/2060/20100037111

No Copyright; Avail.: CASI

Conference presentation sharing aspects of a computational biology approach to modelling and identification of human physiology.

Author

Physiology; Mathematical Models; Bioengineering; Aerospace Medicine; Health Physics

20100037203 NASA Johnson Space Center, Houston, TX, USA

Assessing the Health and Performance Risks of Carbon Dioxide Exposures

James, John T.; Meyers, V. E.; Alexander, D.; [2010]; 1 pp.; In English; Aerospace Medicine Association, 9-12 May 2011, Anchorage, AK, USA

Report No.(s): JSC-CN-22005

ONLINE: http://hdl.handle.net/2060/20100037203

No Copyright; Avail.: CASI

Carbon dioxide (CO2) is an anthropogenic gas that accumulates in spacecraft to much higher levels than earth-normal levels. Controlling concentrations of this gas to acceptable levels to ensure crew health and optimal performance demands major commitment of resources. NASA has many decades of experience monitoring and controlling CO2, yet we are uncertain of the levels at which subtle performance decrements develop. There is limited evidence from ground-based studies that visual disturbances can occur during brief exposures and visual changes have been noted in spaceflight crews. These changes may be due to CO2 alone or in combination with other known spaceflight factors such as increased intracranial pressure due to fluid shifts. Discerning the comparative contribution of each to performance decrements is an urgent issue if we hope to optimize astronaut performance aboard the ISS. Long-term, we must know the appropriate control levels for exploration-class missions to ensure that crewmembers can remain cooperative and productive in a highly stressful environment. Furthermore, we must know the magnitude of interindividual variability in susceptibility to the adverse effects of CO2 so that the most tolerant crewmembers can be identified. Ground-based studies have been conducted for many years to set exposure limits for submariners; however, these studies are typically limited and incompletely reported. Nonetheless, NASA, in cooperation with the National Research Council, has set exposure limits for astronauts using this limited database. These studies do not consider the interactions of spaceflight-induced fluid shifts and CO2 exposures. In an attempt to discern whether CO2 levels affect the incidence of headache and visual disturbances in astronauts we performed a retrospective study comparing average CO2 levels and the prevalence of headache and visual disturbances. Our goal is to narrow gaps in the risk profile for in-flight CO2 exposures. Such studies can provide no more than partial answers to the questions of environmental interactions, interindividual variability, and optimal control levels. Future prospective studies should involve assessment of astronaut well being using sophisticated measures during exposures to levels of CO2 in the range from 2 to 8 mmHg.

Author

Carbon Dioxide; Exposure; Astronaut Performance; Intracranial Pressure; Health; Aerospace Medicine; Spacecrews; Risk; Headache

20100037244 NASA Johnson Space Center, Houston, TX, USA

The New Face of Data Accessibility

Fitts, Mary A.; VanBaalan, Mary; Johnson-Throop, Kathy A.; Thomas, Deidre; Havelka, Jacque; [2010]; 1 pp.; In English; 82nd Annual Scientific Meeting of the Aerospace Medical Association, 8-12 May 2011, Anchorage, AK, USA; Original contains color illustrations

Report No.(s): JSC-CN-22015

ONLINE: http://hdl.handle.net/2060/20100037244

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Management of medical and research data at NASA's Johnson Space Center has been addressed with two separate, independent systems: the Lifetime Surveillance of Astronaut Health (formerly, The Longitudinal Study of Astronaut Health) (LSAH) and the Life Sciences Data Archive (LSDA). Project management for these has been autonomous with little or no

cross-over of goals, objectives or strategy. The result has been limited debate and discussion regarding how contents from one repository might impact or guide the direction of the other. It is decidedly more efficient to use existing data and information than to re-generate them. Ensuring that both clinical and research data / information are accessible for review is a central concept to the decision to unify these repositories. In the past, research data from flight and ground analogs has been held in the LSDA and medical data held in the Electronic Medical Record or in console flight surgeon logs and records. There was little cross-pollination between medical and research findings and, as a result, applicable research was not being fully incorporated into clinical, in-flight practice. Conversely, findings by the console surgeon were not being picked up by the research community. The desired life cycle for risk mitigation was not being fully realized. The goal of unifying these repositories and processes is to provide a closely knit approach to handling medical and research data, which will not only engender discussion and debate but will also ensure that both categories of data and information are used to enhance the use of medical and research data to reduce risk and promote the understanding of space physiology, countermeasures and other mitigation strategies

Author

Aerospace Medicine; Astronauts; Clinical Medicine; Data Management; Medical Science; Data Storage

20100037896 NASA Johnson Space Center, Houston, TX, USA

Potential Technology Needs

Platts, Steven H.; October 22, 2010; 9 pp.; In English; General Electric Technology, 22 Oct. 2010, Albany, NY, USA; Original contains color illustrations

Report No.(s): JSC-CN-21956

ONLINE: http://hdl.handle.net/2060/20100037896

No Copyright; Avail.: CASI

This slide presentation reviews some of the technologies that will be required to maintain crew health. The general principle guiding the technology development is to integrate individual devices into small, flight-ready, reportable units.

CASI

Aerospace Medicine; Spacecrews; Technologies

20100038324 NASA Johnson Space Center, Houston, TX, USA

Radioadaptive Cytoprotective Pathways in the Mouse Retina

Zanello, Susana B.; Wotring, V.; Theriot, C.; Ploutz-Snyder, R.; Zhang, Y.; Wu, H.; [2010]; 1 pp.; In English; 18th Humans in Space Symposium, 11-15 Apr. 2011, Houston, TX, USA

Report No.(s): JSC-CN-21997

ONLINE: http://hdl.handle.net/2060/20100038324

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Exposure to cosmic radiation implies a risk of tissue degeneration. Radiation retinopathy is a complication of radiotherapy and exhibits common features with other retinopathies and neuropathies. Exposure to a low radiation dose elicits protective cellular events (radioadaptive response), reducing the stress of a subsequent higher dose. To assess the risk of radiation-induced retinal changes and the extent to which a small priming dose reduces this risk, we used a mouse model exposed to a source of Cs-137-gamma radiation. Gene expression profiling of retinas from non-irradiated control C57BL/6J mice (C) were compared to retinas from mice treated with a low 50 mGy dose (LD), a high 6 Gy dose (HD), and a combined treatment of 50 mGy (priming) and 6 Gy (challenge) doses (LHD). Whole retina RNA was isolated and expression analysis for selected genes performed by RTqPCR. Relevant target genes associated with cell death/survival, oxidative stress, cellular stress response and inflammation pathways, were analyzed. Cellular stress response genes were upregulated at 4 hr after the challenge dose in LHD retinas (Sirt1: 1.5 fold, Hsf1: 1.7 fold, Hspa1a: 2.5 fold; Hif1a: 1.8 fold, Bag1: 1.7). A similar trend was observed in LD animals. Most antioxidant enzymes (Hmox1, Sod2, Prdx1, Cygb, Cat1) and inflammatory mediators (NF B, Ptgs2 and Tgfb1) were upregulated in LHD and LD retinas. Expression of the pro-survival gene Bcl2 was upregulated in LD (6-fold) and LHD (4-fold) retinas. In conclusion, cytoprotective gene networks activation in the retina suggests a radioadaptive response to a priming irradiation dose, with mitigation of the deleterious effects of a subsequent high dose exposure. The enhancement of these cytoprotective mechanisms has potential value as a countermeasure to ocular alterations caused by radiation alone or in combination with other factors in spaceflight environments.

Author

Cosmic Rays; Gene Expression; Mice; Radiation Therapy; Retina; Cytology; Radiation Dosage

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20100036823 NASA Ames Research Center, Moffett Field, CA, USA
Developing an Advanced Life Support System for the Flexible Path into Deep Space
Jones, Harry W.; Kliss, Mark H.; July 11, 2010; 12 pp.; In English; 40th International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain, Spain
Report No.(s): ARC-E-DAA-TN1694
ONLINE: http://hdl.handle.net/2060/20100036823
No Copyright; Avail.: CASI

Long duration human missions beyond low Earth orbit, such as a permanent lunar base, an asteroid rendezvous, or exploring Mars, will use recycling life support systems to preclude supplying large amounts of metabolic consumables. The International Space Station (ISS) life support design provides a historic guiding basis for future systems, but both its system architecture and the subsystem technologies should be reconsidered. Different technologies for the functional subsystems have been investigated and some past alternates appear better for flexible path destinations beyond low Earth orbit. There is a need to develop more capable technologies that provide lower mass, increased closure, and higher reliability. A major objective of redesigning the life support system for the flexible path is achieving the maintainability and ultra-reliability necessary for deep space operations.
Author
Life Support Systems; Space Missions; Consumables (Spacecraft); Deep Space; Low Earth Orbits; Lunar Bases

20100036831 NASA Johnson Space Center, Houston, TX, USA
Exploration Space Suit Architecture: Destination Environmental-Based Technology Development
Hill, Terry R.; September 2010; 1 pp.; In English; 2011 IEEE Aerospace Conference, 5-11 Mar. 2011, Big Sky, MT, USA
Contract(s)/Grant(s): WBS 731384.06.04.01.31.01.01
Report No.(s): JSC-CN-21249
ONLINE: http://hdl.handle.net/2060/20100036831
No Copyright; Avail.: CASI; Abstract Only

This paper picks up where EVA Space Suit Architecture: Low Earth Orbit Vs. Moon Vs. Mars (Hill, Johnson, IEEEAC paper #1209) left off in the development of a space suit architecture that is modular in design and interfaces and could be reconfigured to meet the mission or during any given mission depending on the tasks or destination. This paper will walk though the continued development of a space suit system architecture, and how it should evolve to meeting the future exploration EVA needs of the USA space program. In looking forward to future US space exploration and determining how the work performed to date in the CxP and how this would map to a future space suit architecture with maximum re-use of technology and functionality, a series of thought exercises and analysis have provided a strong indication that the CxP space suit architecture is well postured to provide a viable solution for future exploration missions. Through the destination environmental analysis that is presented in this paper, the modular architecture approach provides the lowest mass, lowest mission cost for the protection of the crew given any human mission outside of low Earth orbit. Some of the studies presented here provide a look and validation of the non-environmental design drivers that will become every-increasingly important the further away from Earth humans venture and the longer they are away. Additionally, the analysis demonstrates a logical clustering of design environments that allows a very focused approach to technology prioritization, development and design that will maximize the return on investment independent of any particular program and provide architecture and design solutions for space suit systems in time or ahead of being required for any particular manned flight program in the future. The new approach to space suit design and interface definition the discussion will show how the architecture is very adaptable to programmatic and funding changes with minimal redesign effort required such that the modular architecture can be quickly and efficiently honed into a specific mission point solution if required.
Author
Extravehicular Activity; Space Suits; Manned Space Flight; Space Exploration

20100037197 NASA Johnson Space Center, Houston, TX, USA

Simulation and Optimization of Vacuum Swing Adsorption Units for Spacesuit Carbon Dioxide and Humidity Control

Swickrath, Michael J.; Anderson, Molly; McMillin, Summer; Broerman, Craig; [2010]; 1 pp.; In English; 41st International Conference on Environmental Systems (ICES), 17-21 Jul. 2011, Portland, OR, USA

Report No.(s): JSC-CN-21965

ONLINE: http://hdl.handle.net/2060/20100037197

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Controlling carbon dioxide (CO2) and humidity levels in a spacesuit is critical to ensuring both the safety and comfort of an astronaut during extra-vehicular activity (EVA). Traditionally, this has been accomplished utilizing non-regenerative lithium hydroxide (LiOH) or regenerative metal oxide (MetOx) canisters which pose a significant weight burden. Although such technology enables air revitalization, the volume requirements to store the waste canisters as well as the mass to transport multiple units become prohibitive as mission durations increase. Consequently, motivation exists toward developing a fully regenerative technology for environmental control. The application of solid amine materials with vacuum swing adsorption technology has shown the capacity to control CO2 and concomitantly manage humidity levels through a fully regenerative cycle eliminating mission constraints imposed with non-regenerative technologies. Experimental results for full-size and sub-scale test articles have been collected and are described herein. In order to accelerate the developmental efforts, an axially-dispersed plug ow model with an accompanying energy balance has been established and correlated with the experimental data. The experimental and simulation results display good agreement for a variety of ow rates (110-170 SLM), replicated metabolic challenges (100-590 Watts), and atmosphere pressures under consideration for the spacesuit (248 and 760 mm Hg). The relationship between swing adsorption cycles for an outlet criterion of 6.0 mm Hg of CO2 partial pressure has been established for each metabolic challenge. In addition, variable metabolic profiles were imposed on the test articles in order to assess the ability of the technology to transition to new operational constraints. The advent of the model provides the capacity to apply computer-aided engineering practices to support the ongoing efforts to optimize and mature this technology for future application to space exploration.

Author

Carbon Dioxide; Humidity; Space Suits; Optimization; Adsorption; Vacuum; Extravehicular Activity; Astronauts

20100037229 Universities Space Research Association, Houston, TX, USA

A Glimpse of Space Exploration and the Challenges of Life Away from Earth

Zanello, Susana B.; [2010]; 23 pp.; In English; Original contains color illustrations

Report No.(s): JSC-CN-21860

ONLINE: http://hdl.handle.net/2060/20100037229

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This slide presentation provides views of manned space exploration, and some of the challenges and countermeasures that are used to assist in overcoming the hazards of space travel.

CASI

Countermeasures; Space Exploration; Bioastronautics; Aerospace Medicine

20100037960 NASA Johnson Space Center, Houston, TX, USA

Environmental Controls and Life Support System (ECLSS) Design for a Space Exploration Vehicle (SEV)

Stambaugh, Imelda; Sankaran, Subra; [2010]; 1 pp.; In English; International Conference on Environmental Systems, 17-21 Jul. 2011, Portland, OR, USA

Report No.(s): JSC-CN-22013

ONLINE: http://hdl.handle.net/2060/20100037960

Copyright; Distribution as joint owner in the copyright; Avail.: CASI; Abstract Only

Engineers at Johnson Space Center (JSC) are developing an Environmental Control and Life Support System (ECLSS) design for the Space Exploration Vehicle (SEV). The SEV will aid to expand the human exploration envelope for Geostationary Transfer Orbit (GEO), Near Earth Object (NEO), or planetary missions by using pressurized surface exploration vehicles. The SEV, formerly known as the Lunar Electric Rover (LER), will be an evolutionary design starting as a ground test prototype where technologies for various systems will be tested and evolve into a flight vehicle. This paper will discuss the current SEV ECLSS design, any work contributed toward the development of the ECLSS design, and the plan to advance the ECLSS design based on the SEV vehicle and system needs.

Author

Control Systems Design; Environmental Control; Life Support Systems; Interplanetary Flight; Manned Space Flight; Spacecraft Design

20100037965 NASA Ames Research Center, Moffett Field, CA, USA

Human Factor's Research for Space Exploration: Measurement, Modeling, and Mitigation

Kaiser, Mary K.; Allen, Christopher S.; Barshi, Immanuel; Billman, Dorrit; Holden, Kritina L.; September 27, 2010; 4 pp.; In English; 54th Annual Meeting of the Human Factors and Ergonomics Society, 27 Sep. - 1 Oct. 2010, San Francisco, CA, USA

Contract(s)/Grant(s): NA5Z0J3T00; NA2E2F2R00

Report No.(s): ARC-E-DAA-TN1346

ONLINE: http://hdl.handle.net/2060/20100037965

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As part of NASA's Human Research Program, the Space Human Factors Engineering Project serves as the bridge between Human Factors research and Human Spaceflight applications. Our goal is to be responsive to the operational community while addressing issues at a sufficient level of abstraction to ensure that our tools and solutions generalize beyond the point design. In this panel, representatives from four of our research domains will discuss the challenges they face in solving current problems while also enabling future capabilities.

Author

Human Factors Engineering; Space Exploration; Technology Utilization; Long Duration Space Flight

20100037967 NASA Ames Research Center, Moffett Field, CA, USA

Human Systems Integration in the Federal Government

Jones, Patricia M.; Graves, Gaye L.; Allard, Terry; Blackhurst, Jack; Fitts, David J.; Peters, Sean; Piccione, Dino; Shattuck, Lawrence G.; September 27, 2010; 3 pp.; In English; 54th Annual Meeting of the Human Factors and Ergonomics Society, 27 Sep. - 1 Oct. 2010, San Francisco, CA, USA

Report No.(s): ARC-E-DAA-TN1376

ONLINE: http://hdl.handle.net/2060/20100037967

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Human Systems Integration principles and methods can be used to help integrate people, technology, and organizations in an effective and efficient manner. Over the past decade, a wide range of tools, techniques, and technologies have been developed by federal agencies to achieve significant cost and performance benefits. In this discussion, we will explore trends in military human systems integration and learn about the critical role being played by human performance and effectiveness research. We will also examine case studies on the planning and design of future human space flight vehicles, the national air space system and the first nuclear reactors to be built in the USA in over 30 years. And with an eye toward sustaining the discipline s principles and methods, we ll take a look at educating and training the next generation of human systems integration practitioners.

Author

Systems Integration; Governments; Human Factors Engineering; Military Technology; Aerospace Vehicles

20100038326 NASA Johnson Space Center, Houston, TX, USA

Bio-Contamination Control for Spacesuit Garments - A Preliminary Study

Rhodes, Richard; Korona, Adam; Orndoff, Evelyn; Ott, Mark; Poritz, Darwin; [2010]; 1 pp.; In English; 41st International Conference on Environmental Systems, 17-21 Jul. 2011, Portland, OR, USA

Report No.(s): JSC-CN-22067

ONLINE: http://hdl.handle.net/2060/20100038326

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This paper outlines a preliminary study to review, test, and improve upon the current state of spacesuit bio-contamination control. The study includes an evaluation of current and advanced suit materials, ground and on-orbit cleaning methods, and microbial test and analysis methods. The first aspect of this study was to identify potential anti-microbial textiles and cleaning agents, and to review current microbial test methods. The anti-microbial cleaning agent and textile market survey included a review of current commercial-off-the-shelf (COTS) products that could potentially be used as future space flight hardware. This review included replacements for any of the softgood layers that may become contaminated during an extravehicular activity (EVA), including the pressure bladder, liquid cooling garment, and ancillary comfort undergarment. After a series of COTS anti-microbial textiles and cleaning agents were identified, a series of four tests were conducted: (1) a stacked configuration test that was conducted in order to review how bio-contamination would propagate through the various suit layers, (2) a individual materials test that evaluated how well each softgood layer either promoted or repressed growth, (3) a cleaning agent test that evaluated the efficacy on each of the baseline bladders, and (4) an evaluation of various COTS

anti-microbial textiles. All antimicrobial COTS materials tested appeared to control bacteria colony forming unit (CFU) growth better than the Thermal Comfort Undergarment (TCU) and ACES Liquid Cooling Garment (LCG)/EMU Liquid Cooling Ventilation Garment (LCVG) materials currently in use. However, a comparison of fungi CFU growth in COTS to current suit materials appeared to vary per material. All cleaning agents tested in this study appeared to inhibit the level of bacteria and fungi growth to acceptable levels for short duration tests. While several trends can be obtained from the current analysis, a series of test improvements are described for future microbial testing.
Author
Contamination; Space Suits; Extravehicular Activity; Biological Hazards; Microorganisms

20100038343 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Integration Process for the Habitat Demonstration Unit
Gill, Tracy; Merbitz, Jerad; Kennedy, Kriss; Tri, Terry; Howe, A. Scott; August 31, 2010; 1 pp.; In English; AIAA Space 2010 Conference, 31 Aug. - 2 Sep. 2010, Anaheim, CA, USA
Report No.(s): KSC-2010-037
ONLINE: http://hdl.handle.net/2060/20100038343
No Copyright; Avail.: CASI; Abstract Only

The Habitat Demonstration Unit (HDU) is an experimental exploration habitat technology and architecture test platform designed for analog demonstration activities The HDU project has required a team to integrate a variety of contributions from NASA centers and outside collaborators and poses a challenge in integrating these disparate efforts into a cohesive architecture To complete the development of the HDU from conception in June 2009 to rollout for operations in July 2010, a cohesive integration strategy has been developed to integrate the various systems of HDU and the payloads, such as the Geology Lab, that those systems will support The utilization of interface design standards and uniquely tailored reviews have allowed for an accelerated design process Scheduled activities include early fit-checks and the utilization of a Habitat avionics test bed prior to equipment installation into HDU A coordinated effort to utilize modeling and simulation systems has aided in design and integration concept development Modeling tools have been effective in hardware systems layout, cable routing and length estimation, and human factors analysis Decision processes on the shell development including the assembly sequence and the transportation have been fleshed out early on HDU to maximize the efficiency of both integration and field operations Incremental test operations leading up to an integrated systems test allows for an orderly systems test program The HDU will begin its journey as an emulation of a Pressurized Excursion Module (PEM) for 2010 field testing and then may evolve to a Pressurized Core Module (PCM) for 2011 and later field tests, depending on agency architecture decisions The HDU deployment will vary slightly from current lunar architecture plans to include developmental hardware and software items and additional systems called opportunities for technology demonstration One of the HDU challenges has been designing to be prepared for the integration of presently unanticipated systems Results of the HDU field tests will influence future designs of habitat systems.
Author
Human Factors Engineering; Habitats; Deployment; Field Tests; Test Stands; Systems Integration; Avionics; Geology

20100038344 NASA Johnson Space Center, Houston, TX, USA
Altair Lander Life Support: Design Analysis Cycles 4 and 5
Anderson, Molly; Curley, Su; Rotter, Henry; Yagoda, Evan; [2010]; 1 pp.; In English; International Conference on Environmental Systems, 17-21 Jul. 2011, Portland, OR, USA
Report No.(s): JSC-CN-22009
ONLINE: http://hdl.handle.net/2060/20100038344
Copyright; Distribution under U.S. Government purpose rights; Avail.: CASI; Abstract Only

Life support systems are a critical part of human exploration beyond low earth orbit. NASA s Altair Lunar Lander team is pursuing efficient solutions to the technical challenges of human spaceflight. Life support design efforts up through Design Analysis Cycle (DAC) 4 focused on finding lightweight and reliable solutions for the Sortie and Outpost missions within the Constellation Program. In DAC-4 and later follow on work, changes were made to add functionality for new requirements accepted by the Altair project, and to update the design as knowledge about certain issues or hardware matured. In DAC-5, the Altair project began to consider mission architectures outside the Constellation baseline. Selecting the optimal life support system design is very sensitive to mission duration. When the mission goals and architecture change several trade studies must be conducted to determine the appropriate design. Finally, several areas of work developed through the Altair project may be applicable to other vehicle concepts for microgravity missions. Maturing the Altair life support system related analysis, design,

and requirements can provide important information for developers of a wide range of other human vehicles.
Author
Altair Lunar Lander; Life Support Systems; Design Analysis; Space Flight; Space Exploration; Microgravity; Low Earth Orbits

20100038356 NASA Johnson Space Center, Houston, TX, USA
Testing and Results of Vacuum Swing Adsorption Units for Spacesuit Carbon Dioxide and Humidity Control
McMillin, Summer; Broerman, Craig; Swickrath, Mike; Anderson, Molly; [2010]; 1 pp.; In English; International Conference on Environmental Systems, 17-24 Jul. 2011, Portland, OR, USA
Report No.(s): JSC-CN-22056
ONLINE: http://hdl.handle.net/2060/20100038356
Copyright; Distribution under U.S. Government purpose rights; Avail.: CASI; Abstract Only

A principal concern for extravehicular activity (EVA) space suits is the capability to control carbon dioxide (CO2) and humidity (H2O) for the crewmember. The release of CO2 in a confined or unventilated area is dangerous for human health and leads to asphyxiation; therefore, CO2 and H2O become leading factors in the design and development of the spacesuit. An amine-based CO2 and H2O vapor sorbent for use in pressure-swing re-generable beds has been developed by Hamilton Sundstrand. The application of solid-amine materials with vacuum swing adsorption technology has shown the capacity to concurrently manage CO2 and H2O levels through a fully regenerative cycle eliminating mission constraints imposed with non-regenerative technologies. Two prototype solid amine-based systems, known as rapid cycle amine (RCA), were designed to continuously remove CO2 and H2O vapor from a flowing ventilation stream through the use of a two-bed amine based, vacuum-swing adsorption system. The Engineering and Science Contract Group (ESCG) RCA is the first RCA unit implementing radial flow paths, whereas the Hamilton Sundstrand RCA was designed with linear flow paths. Testing was performed in a sea-level pressure environment and a reduced-pressure environment with simulated human metabolic loads in a closed-loop configuration. This paper presents the experimental results of laboratory testing for a full-size and a sub-scale test article. The testing described here characterized and evaluated the performance of each RCA unit at the required Portable Life Support Subsystem (PLSS) operating conditions. The test points simulated a range of crewmember metabolic rates. The experimental results demonstrate the ability of each RCA unit to sufficiently remove CO2 and H2O from a closed loop ambient or subambient atmosphere.
Author
Adsorption; Carbon Dioxide; Extravehicular Activity; Humidity; Space Suits; Vacuum Systems

20100038361 NASA Johnson Space Center, Houston, TX, USA
Injury Potential Testing of Suited Occupants During Dynamic Spacecraft Flight Phases
McFarland, Shane M.; [2010]; 1 pp.; In English; International Conference on Environmental Systems, 17-21 Jul. 2011, Portland, OR, USA
Contract(s)/Grant(s): 731384
Report No.(s): JSC-CN-22031
ONLINE: http://hdl.handle.net/2060/20100038361
No Copyright; Avail.: CASI; Abstract Only

In support of the Constellation Program, a space-suit architecture was envisioned for support of Launch, Entry, Abort, Micro-g EVA, Post Landing crew operations, and under emergency conditions, survival. This space suit architecture is unique in comparison to previous launch, entry, and abort (LEA) suit architectures in that it utilized rigid mobility elements in the scye and the upper arm regions. The suit architecture also employed rigid thigh disconnect elements to allow for quick disconnect functionality above the knee which allowed for commonality of the lower portion of the suit across two suit configurations. This suit architecture was designed to interface with the Orion seat subsystem, which includes seat components, lateral supports, and restraints. Due to this unique configuration of spacesuit mobility elements, combined with the need to provide occupant protection during dynamic landing events, risks were identified with potential injury due to the suit characteristics described above. To address the risk concerns, a test series was developed to evaluate the likelihood and consequences of these potential issues. Testing included use of Anthropomorphic Test Devices (ATDs), Post Mortem Human Subjects (PMHS), and representative seat/suit hardware in combination with high linear acceleration events. The ensuing treatment focuses o detailed results of the testing that has ben conducted under this test series thus far.
Author
Constellation Program; Extravehicular Activity; Human Body; Injuries; Space Suits

55
EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20100036779 NASA Ames Research Center, Moffett Field, CA, USA

Blue Marble: Remote Characterization of Habitable Planets

Woolf, Neville; Lewis, Brian; Chartres, James; Genova, Anthony; August 10, 2009; 12 pp.; In English; 23rd Annual AIAA/USU Conference on Small Satellites: Connecting the Dots, 9-12 Aug. 2010, Logan, UT, USA; Original contains color illustrations

Contract(s)/Grant(s): NNA09DA541; NNX09AF52A

Report No.(s): ARC-E-DAA-TN661; SSC09-IV-1

ONLINE: http://hdl.handle.net/2060/20100036779

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The study of the nature and distribution of habitable environments beyond the Solar System is a key area for Astrobiology research. At the present time, our Earth is the only habitable planet that can be characterized in the same way that we might characterize planets beyond the Solar System. Due to limitations in our current and near-future technology, it is likely that extra-solar planets will be observed as single-pixel objects. To understand this data, we must develop skills in analyzing and interpreting the radiation obtained from a single pixel. These skills must include the study of the time variation of the radiation, and the range of its photometric, spectroscopic and polarimetric properties. In addition, to understand whether we are properly analyzing the single pixel data, we need to compare it with a ground truth of modest resolution images in key spectral bands. This paper discusses the concept for a mission called Blue Marble that would obtain data of the Earth using a combination of spectropolarimetry, spectrophotometry, and selected band imaging. To obtain imagery of the proper resolution, it is desirable to place the Blue Marble spacecraft no closer than the outer region of cis-lunar space. This paper explores a conceptual mission design that takes advantage of low-cost launchers, bus designs and mission elements to provide a cost effective observing platform located at one of the stable Earth-moon Lagrangian points (L4, L5). The mission design allows for the development and use of novel technologies, such as a spinning moon sensor for attitude control, and leverages lessons-learned from previous low-cost spacecraft such as Lunar Prospector to yield a low-risk mission concept.

Author

Exobiology; Extrasolar Planets; Habitability; Polarization Characteristics

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20100036720 NASA Ames Research Center, Moffett Field, CA, USA

Asymptotic Linearity of Optimal Control Modification Adaptive Law with Analytical Stability Margins

Nguyen, Nhan T.; April 20, 2010; 14 pp.; In English; AIAA Infotech at Aerospace 2010, 20-22 Apr. 2010, Atlanta, GA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 457280.02.07.01.02.01

Report No.(s): ARC-E-DAA-TN1485

ONLINE: http://hdl.handle.net/2060/20100036720

No Copyright; Avail.: CASI

Optimal control modification has been developed to improve robustness to model-reference adaptive control. For systems with linear matched uncertainty, optimal control modification adaptive law can be shown by a singular perturbation argument to possess an outer solution that exhibits a linear asymptotic property. Analytical expressions of phase and time delay margins for the outer solution can be obtained. Using the gradient projection operator, a free design parameter of the adaptive law can be selected to satisfy stability margins.

Author

Linearity; Optimal Control; Stability; Asymptotes; Perturbation

20100037780

Non-Deterministic Kleene Coalgebras

Silva, A. M.; Bonsangue, M. M.; Rutten, J. J. M. M.; January 2010; 46 pp.; In English

Contract(s)/Grant(s): SFRH/BD/27482/2006

Report No.(s): PB2010-114491; SEN-1001

Copyright; Avail.: National Technical Information Service (NTIS)

In this paper, we present a systematic way of deriving (1) languages of (generalized) regular expressions, and (2) sound and complete axiomatizations thereof, for a wide variety of systems. This generalizes both the results of Kleene (on regular languages and deterministic finite automata) and Milner (on regular behaviours and finite labelled transition systems), and includes many other systems such as Mealy and Moore machines.

NTIS

Automata Theory; Algebra

20100037782 Center for Mathematics and Computer Science, Amsterdam, Netherlands

Higher Order Implementation of Kahn Networks in Maude: Alternating Bit Protocol

Niqui, M.; February 2010; 20 pp.; In English

Report No.(s): PB2010-114492; SEN-1002

Copyright; Avail.: National Technical Information Service (NTIS)

We implement Kahn networks in Maude system by using behavioural theory of streams and encoding higher order function types. As an example we implement the alternating bit protocol in our framework.

NTIS

Computer Networks; Protocol (Computers)

20100037784 Center for Mathematics and Computer Science, Amsterdam, Netherlands

Coiterative Morphisms: Interactive Equational Reasoning for Bisimulation, using Coalgebras

Niqui, M.; February 2010; 24 pp.; In English

Report No.(s): PB2010-114493; SEN-1003

Copyright; Avail.: National Technical Information Service (NTIS)

We study several techniques for interactive equational reasoning with the bisimulation equivalence. Our work is based on a modular library, formalised in Coq, that axiomatises weakly final coalgebras and bisimulation. As a theory we derive some coalgebraic schemes and an associated coinduction principle. This will help in interactive proofs by coinduction, modular derivation of congruence and co-fixed point equations and enables an extensional treatment of bisimulation. Finally we present a version of the lambda-coinduction proof principle in our framework.

NTIS

Algebra; Equivalence; Congruences

20100037806

Stronger Security Controls Needed on Active Directory Systems

May 2010; 19 pp.; In English

Report No.(s): PB2010-114582; OIG-10-86

No Copyright; Avail.: National Technical Information Service (NTIS)

The Department of Homeland Security uses Microsoft Windows Active Directory services to manage users, groups of users, computer systems, and services on its headquarters network. We reviewed the security of the Active Directory collection of resources and services used by components across the department through trusted connections. These resources and services provide department-wide access to data that supports department missions but require measures to ensure their confidentiality, integrity, and availability. The servers that host these resources must maintain the level of security mandated by department policy.

NTIS

Computer Information Security; Computer Networks; Directories; Security

20100037839 Oak Ridge National Lab., TN USA

Cybersecurity through Real-Time Distributed Control Systems

Kisner, R. A.; Manges, W. W.; MacIntyre, L. P.; Nutaro, J. J.; Munro, J. K.; February 2010; 45 pp.; In English

Contract(s)/Grant(s): DE-AC05-00OR22725

Report No.(s): DE2010-978289; ORNL/TM-2010/30

No Copyright; Avail.: National Technical Information Service (NTIS)

Critical infrastructure sites and facilities are becoming increasingly dependent on interconnected physical and cyber-based real-time distributed control systems (RTDCSs). A mounting cybersecurity threat results from the nature of these ubiquitous and sometimes unrestrained communications interconnections. Much work is under way in numerous organizations to characterize the cyber threat, determine means to minimize risk, and develop mitigation strategies to address potential consequences. While it seems natural that a simple application of cyber-protection methods derived from corporate business information technology (IT) domain would lead to an acceptable solution, the reality is that the characteristics of RTDCSs make many of those methods inadequate and unsatisfactory or even harmful. A solution lies in developing a defense-in-depth approach that ranges from protection at communications interconnect levels ultimately to the control systems functional characteristics that are designed to maintain control in the face of malicious intrusion. This paper summarizes the nature of RTDCSs from a cybersecurity perspective and discusses issues, vulnerabilities, candidate mitigation approaches, and metrics. NTIS

Active Control; Computer Information Security; Distributed Parameter Systems; Real Time Operation

20100037846

Critical Infrastructure Protection: Key Private and Public Cyber Expectations Need to Be Consistently Addressed

July 2010; 38 pp.; In English

Report No.(s): PB2010-113234; GAO-10-628

No Copyright; Avail.: National Technical Information Service (NTIS)

Pervasive and sustained computer-based attacks pose a potentially devastating impact to systems and operations and the critical infrastructures they support. Addressing these threats depends on effective partnerships between the government and private sector owners and operators of critical infrastructure. Federal policy, including the Department of Homeland Security's (DHS) National Infrastructure Protection Plan, calls for a partnership model that includes public and private councils to coordinate policy and information sharing and analysis centers to gather and disseminate information on threats to physical and cyber-related infrastructure. GAO was asked to determine (1) private sector stakeholders' expectations for cyber-related, public-private partnerships and to what extent these expectations are being met and (2) public sector stakeholders' expectations for cyber-related, public-private partnerships and to what extent these expectations are being met. To do this, GAO conducted surveys and interviews of public and private sector officials and analyzed relevant policies and other documents.

NTIS

Computer Information Security; Protection; Security

20100037966 Carnegie-Mellon Univ., Pittsburgh, PA, USA

Initialization and Restart in Stochastic Local Search: Computing a Most Probable Explanation in Bayesian Networks

Mengshoel, Ole J.; Wilkins, David C.; Roth, Dan; May 2010; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NNA08CG83C; NCC2-1426; CCF-0937044; ECCS-0931978; N00014-95-1-0749; DAAL01-96-2-0003; N00014-97-C-2061

Report No.(s): ARC-E-DAA-TN1430

ONLINE: http://hdl.handle.net/2060/20100037966

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For hard computational problems, stochastic local search has proven to be a competitive approach to finding optimal or approximately optimal problem solutions. Two key research questions for stochastic local search algorithms are: Which algorithms are effective for initialization? When should the search process be restarted? In the present work we investigate these research questions in the context of approximate computation of most probable explanations (MPEs) in Bayesian networks (BNs). We introduce a novel approach, based on the Viterbi algorithm, to explanation initialization in BNs. While the Viterbi algorithm works on sequences and trees, our approach works on BNs with arbitrary topologies. We also give a novel formalization of stochastic local search, with focus on initialization and restart, using probability theory and mixture models. Experimentally, we apply our methods to the problem of MPE computation, using a stochastic local search algorithm known as Stochastic Greedy Search. By carefully optimizing both initialization and restart, we reduce the MPE search time

for application BNs by several orders of magnitude compared to using uniform at random initialization without restart. On several BNs from applications, the performance of Stochastic Greedy Search is competitive with clique tree clustering, a state-of-the-art exact algorithm used for MPE computation in BNs.
Author
Stochastic Processes; Bayes Theorem; Computation; Cluster Analysis; Algorithms

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20100037066 NASA Dryden Flight Research Center, Edwards, CA, USA
Software Development to Assist in the Processing and Analysis of Data Obtained Using Fiber Bragg Grating Interrogation Systems
Hicks, Rebecca; June 14, 2010; 32 pp.; In English; Original contains color illustrations
Report No.(s): DFRC-E-DAA-TN1410; DFRC-E-DAA-TN1412; DFRC-E-DAA-TN1413
ONLINE: http://hdl.handle.net/2060/20100037066
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A fiber Bragg grating is a portion of a core of a fiber optic stand that has been treated to affect the way light travels through the strand. Light within a certain narrow range of wavelengths will be reflected along the fiber by the grating, while light outside that range will pass through the grating mostly undisturbed. Since the range of wavelengths that can penetrate the grating depends on the grating itself as well as temperature and mechanical strain, fiber Bragg gratings can be used as temperature and strain sensors. This capability, along with the light-weight nature of the fiber optic strands in which the gratings reside, make fiber optic sensors an ideal candidate for flight testing and monitoring in which temperature and wing strain are factors. A team of NASA Dryden engineers has been working to advance the fiber optic sensor technology since the mid 1990 s. The team has been able to improve the dependability and sample rate of fiber optic sensor systems, making them more suitable for real-time wing shape and strain monitoring and capable of rivaling traditional strain gauge sensors in accuracy. The sensor system was recently tested on the Ikhana unmanned aircraft and will be used on the Global Observer unmanned aircraft. Since a fiber Bragg grating sensor can be placed every halfinch on each optic fiber, and since fibers of approximately 40 feet in length each are to be used on the Global Observer, each of these fibers will have approximately 1,000 sensors. A total of 32 fibers are to be placed on the Global Observer aircraft, to be sampled at a rate of about 50 Hz, meaning about 1.6 million data points will be taken every second. The fiber optic sensors system is capable of producing massive amounts of potentially useful data; however, methods to capture, record, and analyze all of this data in a way that makes the information useful to flight test engineers are currently limited. The purpose of this project is to research the availability of software capable of processing massive amounts of data in both real-time and post-flight settings, and to produce software segments that can be integrated to assist in the task as well. The selected software must be able to: (1) process massive amounts of data (up to 4GB) at a speed useful in a real-time settings (small fractions of a second); (2) process data in post-flight settings to allow test reproduction or further data analysis, inclusive; (3) produce, or make easier to produce, three-dimensional plots/graphs to make the data accessible to flight test engineers; and (4) be customized to allow users to use their own processing formulas or functions and display the data in formats they prefer. Several software programs were evaluated to determine their utility in completing the research objectives. These programs include: OriginLab, Graphis, 3D Grapher, Visualization Sciences Group (VSG) Avizo Wind, Interactive Analysis and Display System (IADS), SigmaPlot, and MATLAB.
Author
Bragg Gratings; Real Time Operation; Fiber Optics; Computer Programming; Flight Tests; Software Engineering; Data Processing

20100037867 NASA Dryden Flight Research Center, Edwards, CA, USA
Software Development to Assist in the Processing and Analysis of Data Obtained Using Fiber Bragg Grating Interrogation Systems
Hicks, Rebecca; August 03, 2009; 6 pp.; In English
Report No.(s): DFRC-E-DAA-TN1412
ONLINE: http://hdl.handle.net/2060/20100037867
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A fiber Bragg grating is a portion of a core of a fiber optic strand that has been treated to affect the way light travels

through the strand. Light within a certain narrow range of wavelengths will be reflected along the fiber by the grating, while light outside that range will pass through the grating mostly undisturbed. Since the range of wavelengths that can penetrate the grating depends on the grating itself as well as temperature and mechanical strain, fiber Bragg gratings can be used as temperature and strain sensors. This capability, along with the light-weight nature of the fiber optic strands in which the gratings reside, make fiber optic sensors an ideal candidate for flight testing and monitoring in which temperature and wing strain are factors. The purpose of this project is to research the availability of software capable of processing massive amounts of data in both real-time and post-flight settings, and to produce software segments that can be integrated to assist in the task as well.
Derived from text
Bragg Gratings; Real Time Operation; Software Engineering; Computer Programming; Systems Analysis

20100037968 NASA Ames Research Center, Moffett Field, CA, USA
The Kepler Science Operations Center Pipeline Framework Extensions
Klaus, Todd C.; Cote, Miles T.; McCauliff, Sean; Girouard, Forrest R.; Wohler, Bill; Allen, Christopher; Chandrasekaran, Hema; Bryson, Stephen T.; Middour, Christopher; Caldwell, Douglas A.; Jenkins, Jon M.; June 18, 2010; 11 pp.; In English; 2010 SPIE Astronomical Instrumentation Conference: Observational Frontiers of Astronomy for the New Decade, 27 Jun. - 2 Jul. 2010, San Diego, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS2-02090
Report No.(s): ARC-E-DAA-TN1814
ONLINE: http://hdl.handle.net/2060/20100037968
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The Kepler Science Operations Center (SOC) is responsible for several aspects of the Kepler Mission, including managing targets, generating on-board data compression tables, monitoring photometer health and status, processing the science data, and exporting the pipeline products to the mission archive. We describe how the generic pipeline framework software developed for Kepler is extended to achieve these goals, including pipeline configurations for processing science data and other support roles, and custom unit of work generators that control how the Kepler data are partitioned and distributed across the computing cluster. We describe the interface between the Java software that manages the retrieval and storage of the data for a given unit of work and the MATLAB algorithms that process these data. The data for each unit of work are packaged into a single file that contains everything needed by the science algorithms, allowing these files to be used to debug and evolve the algorithms offline.
Author
Algorithms; Data Compression; Kepler Mission; Photometers; Cluster Analysis

20100037969 NASA Ames Research Center, Moffett Field, CA, USA
A Framework for Propagation of Uncertainties in the Kepler Data Analysis Pipeline
Clarke, Bruce D.; Allen, Christopher; Bryson, Stephen T.; Caldwell, Douglas A.; Chandrasekaran, Hema; Cote, Miles T.; Girouard, Forrest; Jenkins, Jon M.; Klaus, Todd C.; Li, Jie; Middour, Chris; McCauliff, Sean; Quintana, Elisa V.; Tenebaum, Peter; Twicken, Joseph D.; Wohler, Bill; Wu, Hayley; June 18, 2010; 12 pp.; In English; 2010 SPIE Astronomical Instrumentation Conference: Observational Frontiers of Astronomy for the New Decade, 27 Jun. - 2 Jul. 2010, San Diego, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS2-02090; NNX07AD98A
Report No.(s): ARC-E-DAA-TN1815
ONLINE: http://hdl.handle.net/2060/20100037969
Copyright; Distribution as joint owner in the copyright; Avail.: CASI

The Kepler space telescope is designed to detect Earth-like planets around Sun-like stars using transit photometry by simultaneously observing 100,000 stellar targets nearly continuously over a three and a half year period. The 96-megapixel focal plane consists of 42 charge-coupled devices (CCD) each containing two 1024 x 1100 pixel arrays. Cross-correlations between calibrated pixels are introduced by common calibrations performed on each CCD requiring downstream data products access to the calibrated pixel covariance matrix in order to properly estimate uncertainties. The prohibitively large covariance matrices corresponding to the ~75,000 calibrated pixels per CCD preclude calculating and storing the covariance in standard lock-step fashion. We present a novel framework used to implement standard propagation of uncertainties (POU) in the Kepler Science Operations Center (SOC) data processing pipeline. The POU framework captures the variance of the raw pixel data and the kernel of each subsequent calibration transformation allowing the full covariance matrix of any subset of calibrated pixels to be recalled on-the-fly at any step in the calibration process. Singular value decomposition (SVD) is used to compress

and low-pass filter the raw uncertainty data as well as any data dependent kernels. The combination of POU framework and SVD compression provide downstream consumers of the calibrated pixel data access to the full covariance matrix of any subset of the calibrated pixels traceable to pixel level measurement uncertainties without having to store, retrieve and operate on prohibitively large covariance matrices. We describe the POU Framework and SVD compression scheme and its implementation in the Kepler SOC pipeline.
Author
Data Processing; Kepler Mission; Propagation; Matrices (Mathematics); Photometry; Calibrating; Algorithms

20100037971 NASA Ames Research Center, Moffett Field, CA, USA
The Kepler End-to-End Model: Creating High-Fidelity Simulations to Test Kepler Ground Processing
Bryson, Stephen T.; Jenkins, Jon M.; Peters, Dan J.; Tenenbaum, Peter P.; Klaus, Todd C.; Gunter, Jay P.; Cote, Miles T.; Caldwell, Douglas A.; June 29, 2010; 5 pp.; In English; 2010 SPIE Astronomical Instrumentation Conference: Observational Frontiers of Astronomy for the New Decade, 27 Jun. - 2 Jul. 2010, San Diego, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): NNA05CR02C; NAS2-02090; NNX07AD96A
Report No.(s): ARC-E-DAA-TN1881
ONLINE: http://hdl.handle.net/2060/20100037971
Copyright; Distribution as joint owner in the copyright; Avail.: CASI

The Kepler mission is designed to detect the transit of Earth-like planets around Sun-like stars by observing 100,000 stellar targets. Developing and testing the Kepler ground-segment processing system, in particular the data analysis pipeline, requires high-fidelity simulated data. This simulated data is provided by the Kepler End-to-End Model (ETEM). ETEM simulates the astrophysics of planetary transits and other phenomena, properties of the Kepler spacecraft and the format of the downlinked data. Major challenges addressed by ETEM include the rapid production of large amounts of simulated data, extensibility and maintainability.
Author
Astrophysics; Kepler Mission; Simulation; Photometry; Mathematical Models; End-to-End Data Systems

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20100036752 United Space Alliance, Cape Canaveral, FL, USA
Systems Engineering Model and Training Application for Desktop Environment
May, Jeffrey T.; April 26, 2010; 9 pp.; In English; 11th International Conference on Space Operations, 26-30 Apr. 2010, Huntsville, AL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NNJ06VA01C
Report No.(s): KSC-2010-020
ONLINE: http://hdl.handle.net/2060/20100036752
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Provide a graphical user interface based simulator for desktop training, operations and procedure development and system reference. This simulator allows for engineers to train and further understand the dynamics of their system from their local desktops. It allows the users to train and evaluate their system at a pace and skill level based on the user's competency and from a perspective based on the user's need. The simulator will not require any special resources to execute and should generally be available for use. The interface is based on a concept of presenting the model of the system in ways that best suits the user's application or training needs. The three levels of views are Component View, the System View (overall system), and the Console View (monitor). These views are portals into a single model, so changing the model from one view or from a model manager Graphical User Interface will be reflected on all other views.
Author
Systems Engineering; Graphical User Interface; Education; Training Simulators

20100037224 NASA Stennis Space Center, Stennis Space Center, MS, USA
Integrated Systems Health Management for Intelligent Systems
Figueroa, Fernando; Melcher, Kevin; [2010]; 1 pp.; In English; AIAA Infotech\@Aerospace 2011, 29-31 Mar. 2011, Saint Louis, MO, USA
Report No.(s): SSTI-2200-0118
ONLINE: http://hdl.handle.net/2060/20100037224
No Copyright; Avail.: CASI; Abstract Only

The implementation of an integrated system health management (ISHM) capability is fundamentally linked to the management of data, information, and knowledge (DIaK) with the purposeful objective of determining the health of a system. It is akin to having a team of experts who are all individually and collectively observing and analyzing a complex system, and communicating effectively with each other in order to arrive at an accurate and reliable assessment of its health. In this paper, concepts, procedures, and approaches are presented as a foundation for implementing an intelligent systems]relevant ISHM capability. The capability stresses integration of DIaK from all elements of a system. Both ground-based (remote) and on-board ISHM capabilities are compared and contrasted. The information presented is the result of many years of research, development, and maturation of technologies, and of prototype implementations in operational systems.
Author
Complex Systems; Systems Integration; Systems Health Monitoring; Technology Utilization

20100037831; Stanford Univ., Stanford, CA USA
Simulation-Based Computation of the Workload Correlation Function in a Levy-Driven Queue (2010 Update)
Glynn, P. W.; Mandjes, M.; May 21, 2010; 22 pp.; In English
Report No.(s): PB2010-114935; PNA-1004
Copyright; Avail.: National Technical Information Service (NTIS)

In this paper we consider a single-server queue with Levy input, and in particular its workload process (Q(sub t))t greater than or equal to 0, focusing on its correlation structure. With the correlation function defined as r(t): equals Cov(Q(sub 0))(Q(sub t))/Var Q(sub 0) (assuming the workload process is in stationarity at time 0), we first study its transform Intergral(sub 0, sup infinity)r(t)e(sup -vt)dt, both for the case that the Levy process has positive jumps, and that it has negative jumps. These expressions allow us to prove that r(center dot) is positive, decreasing, and convex, relying on the machinery of completely monotone functions. For the light-tailed case, we estimate the behavior of r(t) for t large. We then focus on techniques to estimate r(t) by simulation. Naive simulation techniques require roughly (r(t))(sup -2) runs to obtain an estimate of a given precision, but we develop a coupling technique that leads to substantial variance reduction (required number of runs being roughly (r(t))(sup -1)). If this is augmented with importance sampling, it even leads to a logarithmically efficient algorithm.
NTIS
Correlation; Simulation; Workloads (Psychophysiology)

70
PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20100037836
Nevada Test Site Directed Research and Development. FY 2009 Report
April 2010; 234 pp.; In English
Contract(s)/Grant(s): DE-AC52-06NA25946
Report No.(s): DE2010-977624; DOE/NV/25946-895
No Copyright; Avail.: National Technical Information Service (NTIS)

Fiscal year (FY) 2009 marked a significant year of accomplishment for the Site-Directed Research and Development (SDRD) program. Numerous successes in technical innovation and advanced engineering directly illustrate the program's positive impact on the Nevada Test Site (NTS) mission and the broader needs of national security. In particular, 10 SDRD-developed technologies were integrated into direct support areas in stockpile stewardship, non-proliferation, and homeland security applications. Eleven invention disclosures were submitted based on SDRD activities, multiple articles were

published in peer-review journals, and several presentations given at technical conferences. The program also continues to generate R&D 100 award submissions emphasising implementation ready solutions to national security issues. In addition, four projects were presented at the Laboratory Directed Research and Development Symposium in Washington, D.C., where the theme was 'Strengthening America's Infrastructure Security.' These projects were well received by representatives of a diverse community that included NNSA, the National Weapons Laboratories (NWL), the Department of Homeland Security, and the Department of Defense.
NTIS
Particle Accelerators; Research and Development

20100037838 Oak Ridge National Lab., TN USA
Passive and Active Fast-Neutron Imaging in Support of AFCI Safeguards Campaign
Hausladen, P.; Blackston, M.; August 2009; 15 pp.; In English
Contract(s)/Grant(s): DE-AC05-00OR22725
Report No.(s): DE2010-978279; ORNL/TM-2009/210
No Copyright; Avail.: National Technical Information Service (NTIS)

Results from safeguards-related passive and active coded-aperture fast-neutron imaging measurements of plutonium and highly enriched uranium (HEU) material configurations performed at Idaho National Laboratory's Zero Power Physics Reactor facility are presented. The imaging measurements indicate that it is feasible to use fast neutron imaging in a variety of safeguards-related tasks, such as monitoring storage, evaluating holdup deposits in situ, or identifying individual leached hulls still containing fuel. The present work also presents the first demonstration of imaging of differential die away fast neutrons.
NTIS
Fast Neutrons; Imaging Techniques; Nuclear Transformations

20100037871
Full Scale Coated Fiber Neutron Detector Measurements
Kouzes, R. T.; Ely, J. H.; Erikson, L. E.; Kernan, W. J.; Stromswold, D. C.; March 17, 2010; 28 pp.; In English
Contract(s)/Grant(s): DE-AC05-76RL01830
Report No.(s): DE2010-976988; PNNL-19264
No Copyright; Avail.: National Technical Information Service (NTIS)

Radiation portal monitors used for interdiction of illicit materials at borders include highly sensitive neutron detection systems. The main reason for having neutron detection capability is to detect fission neutrons from plutonium. The currently deployed radiation portal monitors (RPMs) from Ludlum and Science Applications International Corporation (SAIC) use neutron detectors based upon 3He-filled gas proportional counters, which are the most common large neutron detector. There is a declining supply of 3He in the world, and thus, methods to reduce the use of this gas in RPMs with minimal changes to the current system designs and sensitivity to cargo-borne neutrons are being investigated. Four technologies have been identified as being currently commercially available, potential alternative neutron detectors to replace the use of 3He in RPMs. These technologies are: 1) Boron trifluoride (BF3)-filled proportional counters, 2) Boron-lined proportional counters, 3) Lithium-loaded glass fibers, and 4) Coated non-scintillating plastic fibers.
NTIS
Coatings; Detection; Monitors; Neutron Counters; Neutrons

74
OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20100036714 NASA Marshall Space Flight Center, Huntsville, AL, USA
ATLAST-8 Mission Concept Study for 8-Meter Monolithic UV/Optical Space Telescope
Stahl, H. Philip; Postman, Marc; Arnold, William R., Sr.; Hopkins, Randall C.; Hornsby, Linda; Mosier, Gary E.; Pasquale, Bert A.; June 27, 2010; 46 pp.; In English; SPIE Astronomical Instrumentation 2010: Observational Frontiers of Astronomy for the New Decade, 27 Jun. - 2 Jul. 2010, San Diego, CA, USA
Report No.(s): M10-0436; M10-0837; M10-0848
ONLINE: http://hdl.handle.net/2060/20100036714
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ATLAST-8m is an 8-meter monolithic UV/optical/NIR space observatory which could be placed in orbit at Sun-Earth L2 by a heavily lift launch vehicle. Two development study cycles have resulted in a detailed concept including a dual foci optical design; several primary mirror launch support and secondary mirror support structural designs; spacecraft propulsion, power and pointing control design; and thermal design. ATLAST-8m is designed to yield never before achieved performance to obtain fundamental astronomical breakthroughs
Author
Design Analysis; Mission Planning; Optical Equipment; Spaceborne Telescopes; Structural Design; Ultraviolet Telescopes; Solar Instruments; Solar Observatories

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

20100036830 NASA Langley Research Center, Hampton, VA, USA
A Safety Conundrum Illustrated: Logic, Mathematics, and Science Are Not Enough
Holloway, C. M.; Johnson, C. W.; Collins, Kristine R.; October 18, 2010; 6 pp.; In English; 5th IET International System Safety Conference 2010, 18-20 Oct. 2010, Manchester, UK
Contract(s)/Grant(s): WBS 757280.02.07.07.07
Report No.(s): NF1676L-10987
ONLINE: http://hdl.handle.net/2060/20100036830
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In an ideal world, conversations about whether a particular system is safe, or whether a particular method or tool enhances safety, would be emotion-free discussions concentrating on the level of safety required, available evidence, and coherent logical, mathematical, or scientific arguments based on that evidence. In the real world, discussions about safety are often not emotion-free. Political and economic arguments may play a bigger role than logical, mathematical, and scientific arguments, and psychological factors may be as important, or even more important, than purely technical factors. This paper illustrates the conundrum that can result from this clash of the ideal and the real by means of an imagined conversation among a collection of fictional characters representing various types of people who may be participating in a safety discussion.
Author
Conversation; Safety; Psychological Factors; Logic Design

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20100036820 NASA, Washington, DC, USA
International Project Management Committee: Overview and Activities
Hoffman, Edward; September 23, 2010; 8 pp.; In English; 61st International Astronautical Congress, 23 Sep. - 2 Oct. 2010, Prague, Czech Republic; Original contains color illustrations
Report No.(s): HQ-STI-10-151
ONLINE: http://hdl.handle.net/2060/20100036820
No Copyright; Avail.: CASI

This slide presentation discusses the purpose and composition of the International Project Management Committee (IMPC). The IMPC was established by members of 15 space agencies, companies and professional organizations. The goal of the committee is to establish a means to share experiences and best practices with space project/program management practitioners at the global level. The space agencies that are involved are: AEB, DLR, ESA, ISRO, JAXA, KARI, and NASA. The industrial and professional organizational members are Comau, COSPAR, PMI, and Thales Alenia Space.
CASI
International Cooperation; Procedures; Project Management; Space Programs

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20100036756 NASA Ames Research Center, Moffett Field, CA, USA
Evolving from Planning and Scheduling to Real-Time Operations Support: Design Challenges
Marquez, Jessica J.; Ludowise, Melissa; McCurdy, Michael; Li, Jack; July 11, 2010; 7 pp.; In English; 40th International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain, Spain; Original contains color illustrations
Contract(s)/Grant(s): WBS 575376.07.01.04.01.06
Report No.(s): ARC-E-DAA-TN1534
ONLINE: http://hdl.handle.net/2060/20100036756
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Versions of Scheduling and Planning Interface for Exploration (SPIFe) have supported a variety of mission operations across NASA. This software tool has evolved and matured over several years, assisting planners who develop intricate schedules. While initially conceived for surface Mars missions, SPIFe has been deployed in other domains, where people rather than robotic explorers, execute plans. As a result, a diverse set of end-users has compelled growth in a new direction: supporting real-time operations. This paper describes the new needs and challenges that accompany this development. Among the key features that have been built for SPIFe are current time indicators integrated into the interface and timeline, as well as other plan attributes that enable execution of scheduled activities. Field tests include mission support for the Lunar CRater Observation and Sensing Satellite (LCROSS), NASA Extreme Environment Mission Operations (NEEMO) and Desert Research and Technology Studies (DRATS) campaigns.
Author
Mars Missions; Scheduling; Mission Planning; Space Missions; Operations Research; NASA Programs; Schedules; Real Time Operation

20100037237 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
JPL Library, Archives, and Records Update
Amago, Barbara; Young, Margo; October 21, 2010; 9 pp.; In English; Research Center Information Managers Meeting, 21-22 Oct. 2010, El Segundo, CA, USA; Original contains color illustrations
ONLINE: http://hdl.handle.net/2014/41667
Copyright; Avail.: Other Sources

This slide presentation reviews the changes and plans that the JPL Library, Archives and Records Management group have instituted and plan to in 2011.
Author
Libraries; Records Management; Information Resources Management; Documentation

20100037899 NASA Langley Research Center, Hampton, VA, USA
NASA Patent Abstracts Bibliography: A Continuing Bibliography, Supplement 71
October 2010; 135 pp.; In English; Original contains black and white illustrations
Report No.(s): NASA/SP-2010-7039/SUPPL71
ONLINE: http://hdl.handle.net/2060/20100037899
No Copyright; Avail.: CASI

This report lists NASA patent abstracts announced in the NASA Aeronautics and Space Database over the past 12 months. Author

Bibliographies; Inventions; NASA Programs; Data Bases

20100037961 NASA Johnson Space Center, Houston, TX, USA
Harnessing the Risk-Related Data Supply Chain: An Information Architecture Approach to Enriching Human System Research and Operations Knowledge
Buquo, Lynn; Johnson-Throop, Kathy; [2010]; 1 pp.; In English; 82nd Annual Scientific Meeting of the Aerospace Medical Association, 8-12 May 2011, Anchorage, AK, USA
Report No.(s): JSC-CN-22017
ONLINE: http://hdl.handle.net/2060/20100037961
No Copyright; Avail.: CASI; Abstract Only

NASA's Human Research Program (HRP) and Space Life Sciences Directorate (SLSD), not unlike many NASA organizations today, struggle with the inherent inefficiencies caused by dependencies on heterogeneous data systems and silos of data and information spread across decentralized discipline domains. The capture of operational and research-based data/information (both in-flight and ground-based) in disparate IT systems impedes the extent to which that data/information can be efficiently and securely shared, analyzed, and enriched into knowledge that directly and more rapidly supports HRP's research-focused human system risk mitigation efforts and SLSD s operationally oriented risk management efforts. As a result, an integrated effort is underway to more fully understand and document how specific sets of risk-related data/information are generated and used and in what IT systems that data/information currently resides. By mapping the risk-related data flow from raw data to useable information and knowledge (think of it as the data supply chain), HRP and SLSD are building an information architecture plan to leverage their existing, shared IT infrastructure. In addition, it is important to create a centralized structured tool to represent risks including attributes such as likelihood, consequence, contributing factors, and the evidence supporting the information in all these fields. Representing the risks in this way enables reasoning about the risks, e.g. revisiting a risk assessment when a mitigation strategy is unavailable, updating a risk assessment when new information becomes available, etc. Such a system also provides a concise way to communicate the risks both within the organization as well as with collaborators. Understanding and, hence, harnessing the human system risk-related data supply chain enhances both organizations' abilities to securely collect, integrate, and share data assets that improve human system research and operations.

Derived from text

Information Flow; Risk Management; Data Systems; Information Management; Information Systems; Risk

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TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20100037895 NATO Research and Technology Organization, Neuilly-sur-Seine, France
Urban Combat Advanced Training Technology
April 2010; 206 pp.; In English; Original contains color illustrations
Report No.(s): RTO-TR-MSG-032; AC/323(MSG-032)TP/293
Copyright; Avail.: CASI

The Urban Combat Advanced Training Technology (UCATT) Task Group (TG) was established within the NATO Modelling and Simulation Group (NMSG) in 2003 as MSG-032 TG-023. The UCATT TG was tasked to exchange and assess information on Military Operations in Urban Terrain (MOUT) facilities and training/simulation systems with a view toward establishing best practice. In addition it was required to identify a suitable architecture and a standard set of interfaces that

would enable interoperability of MOUT training components without inhibiting future enhancements, and pinpoint limitations and constraints on MOUT development so that areas for future research could be identified. The end product of this TG is this comprehensive report detailing an architectural framework to enable interoperability and future research requirements for MOUT training facilities. This report covers the work of UCATT from its inception and the work conducted to date which includes the development of a MOUT website and architectural framework based on USE CASES and an analysis of the functional components mapped to national requirements for live force-on-force urban training.
Author
Cities; Education; Military Operations; Simulation

88
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20100036777 NASA Johnson Space Center, Houston, TX, USA
NASA Human Spaceflight Conjunction Assessment: Recent Conjunctions of Interest
Browns, Ansley C.; October 20, 2010; 15 pp.; In English; USSTRATCOM Conjunction Summary Workshop #2, 20-22 Oct. 2010, Darmstadt, Germany; Original contains color and black and white illustrations
Report No.(s): JSC-CN-21823
ONLINE: http://hdl.handle.net/2060/20100036777
No Copyright; Avail.: CASI

This viewgraph presentation discusses a brief history of NASA Human Spaceflight Conjunction Assessment (CA) activities, an overview of NASA CA process for ISS and Shuttle, and recent examples from Human Spaceflight conjunctions. CASI
Histories; NASA Space Programs; Manned Space Flight; General Overviews; International Space Station

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LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20100036718 NASA Ames Research Center, Moffett Field, CA, USA
South Pole Hydrogen Distribution for Present Lunar Conditions: Implications for Past Impacts
Elphic, R. C.; Paige, D. A.; Siegler, M. A.; Vasavada, A. R.; Eke, V. R.; Teodoro, L. F. A.; Lawrence, D. J.; March 05, 2010; 16 pp.; In English; 41st Lunar and Planetary Science Conference, 1-5 Mar. 2010, The Woodlands, TX, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 964946.02.01.01.33
Report No.(s): ARC-E-DAA-TN1331
ONLINE: http://hdl.handle.net/2060/20100036718
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It has been known since the Lunar Prospector mission that the poles of the Moon evidently harbor enhanced concentrations of hydrogen [1,2]. The physical and chemical form of the hydrogen has been much debated. Using imagery from Clementine it was possible to roughly estimate permanently-shadowed regions (PSRs), and to perform image reconstructions of the Lunar Prospector epithermal neutron flux maps [3,4]. The hydrogen concentrations resulting from these reconstructions were consistent with a few weight percent water ice in selected locations. With the LCROSS impact, we now know that hydrogen in the form of ice does exist in lunar polar cold traps [5]. Armed with this information, and new data from LRO/Diviner, we can examine whether the pre-sent-day distribution of hydrogen in the form of water ice is consistent with a past large impact that delivered a large mass of volatiles to the lunar surface. These volatiles, mixed with solid impact ejecta, would then be lost from locations having high mean temperatures but would otherwise remain trapped in locations with

sufficiently low mean annual temperatures [6]. The time scales for loss would depend on the location-dependent temperatures as well as impact history.
Author
Hydrogen; Lunar Surface; Aerospace Sciences; Polar Regions; Southern Hemisphere

20100036726 Embry-Riddle Aeronautical Univ., Daytona Beach, FL, USA
Reaching Out: Team AETHER
Murphy, Gloria A.; [2010]; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NNX09AU58G
Report No.(s): KSC-2010-225
ONLINE: http://hdl.handle.net/2060/20100036726
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Embry Riddle Aeronautical University's Daytona Beach Campus Lunabotics Team took the opportunity to share the love of space, engineering and technology through the educational outreach portion of the competition. Through visits to elementary schools and high schools, and through support of science fairs and robotics competitions, younger generations were introduced to space, engineering and robotics. This report documents the outreach activities of team Aether.
Author
Education; Robotics; Aeronautical Engineering; Lunar Surface; Moon; Aerospace Sciences

20100036754 NASA Ames Research Center, Moffett Field, CA, USA
Assessment of Scheduling and Plan Execution of Apollo 14 Lunar Surface Operations
Marquez, Jessica J.; July 11, 2010; 10 pp.; In English; 40th International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain, Spain; Original contains color illustrations
Contract(s)/Grant(s): WBS 575376.07.01.04.01.06
Report No.(s): ARC-E-DAA-TN1536
ONLINE: http://hdl.handle.net/2060/20100036754
No Copyright; Avail.: CASI

Although over forty years have passed since first landing on the Moon, there is not yet a comprehensive, quantitative assessment of Apollo extravehicular activities (EVAs). Quantitatively evaluating lunar EVAs will provide a better understanding of the challenges involved with surface operations. This first evaluation of a surface EVA centers on comparing the planned and the as-ran timeline, specifically collecting data on discrepancies between durations that were estimated versus executed. Differences were summarized by task categories in order to gain insight as to the type of surface operation activities that were most challenging. One Apollo 14 EVA was assessed utilizing the described methodology. Selected metrics and task categorizations were effective, and limitations to this process were identified.
Author
Extravehicular Activity; Lunar Surface; Scheduling; Data Acquisition

20100037201 Boston Univ., Boston, MA, USA
Orbital Effects on Mercury's Escaping Sodium Exosphere
Schmidt, Carl A.; Wilson, Jody K.; Baumgardner, Jeffrey; Mendillo, Michael; Icarus; November 03, 2009; ISSN 0019-1035; Volume 207, Issue 1, pp. 9-16; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNG05GQ09G
ONLINE: http://dx.doi.org/10.1016/j.icarus.2009.10.017
Copyright; Avail.: Other Sources

We present results from coronagraphic imaging of Mercury's sodium tail over a 7 deg field of view. Several sets of observations made at the McDonald Observatory since May 2007 show a tail of neutral sodium atoms stretching more than 1000 Mercury radii (R(sub m)) in length, or a full degree of sky. However, no tail was observed extending beyond 120 R(sub m) during the January 2008 MESSENGER Fly-by period, or during a similar orbital phase of Mercury in July 2008. Large changes in Mercury's heliocentric radial velocity cause Doppler shifts about the Fraunhofer absorption features; the resultant change in solar flux and radiation pressure is the primary cause of the observed variation in tail brightness. Smaller fluctuations in brightness may exist due to changing source rates at the surface, but we have no explicit evidence for such changes in this data set. The effects of radiation pressure on Mercury's escaping atmosphere are investigated using seven observations spanning different orbital phases. Total escape rates of atmospheric sodium are estimated to be between 5 and 13 x 10(exp

23) atoms/s and show a correlation to radiation pressure. Candidate sources of Mercury's sodium exosphere include desorption by UV sunlight, thermal desorption, solar wind channeled along Mercury's magnetic field lines, and micro-meteor impacts. Wide-angle observations of the full extent of Mercury's sodium tail offer opportunities to enhance our understanding of the time histories of these source rates.
Author
Mercury (Planet); Mercury Atmosphere; Radiation Effects; Sodium

20100038322 NASA Johnson Space Center, Houston, TX, USA
Extracting Oxygen from Lunar Simulant Using a Transparent Furnace Pulsed Fluidized Bed
Oryshchyn, L.; Paz, A.; Lee, K.; Reddington, M.; [2010]; 1 pp.; In English; 49th AIAA Aerospace Sciences Meeting, 4-7 Jan. 2011, Orlando, FL, USA
Contract(s)/Grant(s): WBS 387498.04.01.02.01.10
Report No.(s): JSC-CN-21723
ONLINE: http://hdl.handle.net/2060/20100038322
No Copyright; Avail.: CASI; Abstract Only

In the event that humans return to the moon, utilizing the local materials will be beneficial for extended stays. Rather than transporting resources, such as oxygen, from Earth, NASA is investigating methods of extracting it from lunar regolith. One promising process is hydrogen reduction. In the hydrogen reduction process, lunar regolith is heated to 1000 C in the presence of hydrogen. The iron oxide (Fe-O) bonds, found in lunar material, are broken and the hydrogen attracts the oxygen to produce water vapor [Allen et al., 1996]. FeO + H2 (right arrow) Fe +H2O. The water vapor is then captured, cleaned, and electrolyzed. The hydrogen is recycled back to the reduction process and the oxygen is stored until consumed by an end user (propulsion, life support, etc.). To obtain a good oxygen yield, the majority of lunar regolith must be exposed to the hydrogen gas and have a high rate of heat transfer from heat source to particle. This is achieved with good solids mixing via fluidization or mechanical agitation. In Generation II of the ROxygen program, the ROxygen Team at Johnson Space Center (JSC) investigated the feasibility of gas only pulsed fluidization as the only means to mix synthetic lunar regolith (simulant) at high temperatures. Fluidized beds have been used in industry to effectively process powders for decades. They consist of gas flowing upward through a bed of particles. The stirring action continuously moves the grains around to achieve uniform mixing of gas, solids, and heat [Geldart, 1986]. A transparent furnace unit was developed by Thoughventions Unlimited LLC (TvU) to aid in the qualitative observation of the fluidization behavior at high temperatures. Multipoint thermocouples and pressure sensors provided quantitative information regarding the quality of mixing. The water produced was measured using humidity sensors and captured using a NASA designed and built condenser. Once the simulant was processed, pneumatically transporting the 'hot' simulant out of the furnace was investigated.
Author
Fluidized Bed Processors; Furnaces; Lunar Rocks; Oxygen; Transparence; Extraction; Iron Oxides

20100038347 NASA Johnson Space Center, Houston, TX, USA
Permissible Exposure Level for Lunar Dusts: Gaps are Closing
James, John T.; Lam, Chiu-Wing; Scully Robert; Santana, Patricia; Cooper, Bonnie; McKay, David; Zeidler-Erdely, Patti C.; Castranova, Vincent; January 2010; 1 pp.; In English; IAA Humans in Space Symposium, 11-15 Apr. 2011, Houston, TX, USA; Original contains black and white illustrations
Report No.(s): JSC-CN-22024
ONLINE: http://hdl.handle.net/2060/20100038347
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Space faring nations plan to return human explorers to the moon within the next decade. Experience during the Apollo flights suggests that lunar dust will invariably get into the habitat where the finest portion (less than 5 micrometers) could be inhaled by the crew before it is cleared from the atmosphere. NASA is developing a database from which a 6-month, episodic exposure standard for lunar dust can be set. Three kinds of moon dust were prepared from a parent sample of Apollo 14 regolith #14003,96. Our goal was to prepare each type of dust sample with a mean diameter less than 2 m, which is suitable for instillation into the lungs of rats. The three samples were prepared as follows: separation from the parent sample using a fluidized bed, grinding using a jet mill grinder, or grinding with a ball-mill grinder. Grinding simulated restoration of surface activation of dust expected to occur at the surface of the moon on native lunar dust. We used two grinding methods because they seemed to produce different modes of activation. The effects of grinding were preserved by maintaining the dust in ultra-pure nitrogen until immediately before it was placed in suspension for administration to rats. The dust was suspended in physiological saline with 10% Survanta, a lung surfactant. Rats were given intratrachael instillations of the dust suspension

at three doses. In addition to the three moon dusts (A, C and E), we instilled the same amount of a negative control (TiO2, B) and a highly-toxic, positive control (quartz, D). These additional mineral dusts were selected because they have well-established and very different permissible exposure levels (PELs). Our goal was to determine where lunar dusts fit between these extremes, and then estimate a PEL for each lunar dust. We evaluated many indices of toxicity to the lung. The figure shows the changes in lactate dehydrogenase (LDH), a marker of cell death, for the five dusts. Benchmark dose software (Version 2.1.2) from the Environmental Protection Agency was used to estimate the 10% effect levels (BMD(sub 10)) using five models. The best-fitting model was used to estimate the optimal BMD(sub 10) (table)
Author
Exposure; Lunar Dust; Permissivity; Dust; Apollo Flights; Toxins and Antitoxins

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20100036758 NASA Johnson Space Center, Houston, TX, USA
Feasibility Investigation for a Solar Power Generation Facility
Nathan, Lakshmi; [2010]; 5 pp.; In English; Original contains color illustrations
Report No.(s): JSC-CN-21191
ONLINE: http://hdl.handle.net/2060/20100036758
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The Energy Policy Act of 2005 states that by fiscal year 2013, at least 7.5% of the energy consumed by the government must be renewable energy. In an effort to help meet this goal, Johnson Space Center (JSC) is considering installing a solar power generation facility. The purpose of this project is to conduct a feasibility investigation for such a facility. Because Kennedy Space Center (KSC) has a solar power generation facility, the first step in this investigation is to learn about KSC's facility and obtain information on how it was constructed. After collecting this information, the following must be determined: the amount of power desired, the size of the facility, potential locations for it, and estimated construction and maintenance costs. Contacts with JSC's energy provider must also be established to determine if a partnership would be agreeable to both parties. Lastly, all of this data must be analyzed to decide whether or not JSC should construct the facility. The results from analyzing the data collected indicate that a 200 kW facility would provide enough energy to meet 1% of JSC's energy demand. This facility would require less than 1 acre of land. In the map below, potential locations are shown in green. The solar power facility is projected to cost $2 M. So far, the information collected indicates that such a facility could be constructed. The next steps in this investigation include contacting JSC's energy provider, CenterPoint Energy, to discuss entering a partnership; developing a life cycle cost analysis to determine payback time; developing more detailed plans; and securing funding.
Author
Feasibility Analysis; Solar Generators; Renewable Energy; Panels

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GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20100037869 NASA Langley Research Center, Hampton, VA, USA
NASA Video Catalog
October 2010; 320 pp.; In English
Report No.(s): NASA/SP-2010-7109/SUPPL20
ONLINE: http://hdl.handle.net/2060/20100037869
No Copyright; Avail.: CASI

This report lists video productions from the NASA STI database.
Author
Video Tapes; Catalogs (Publications); Data Bases

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